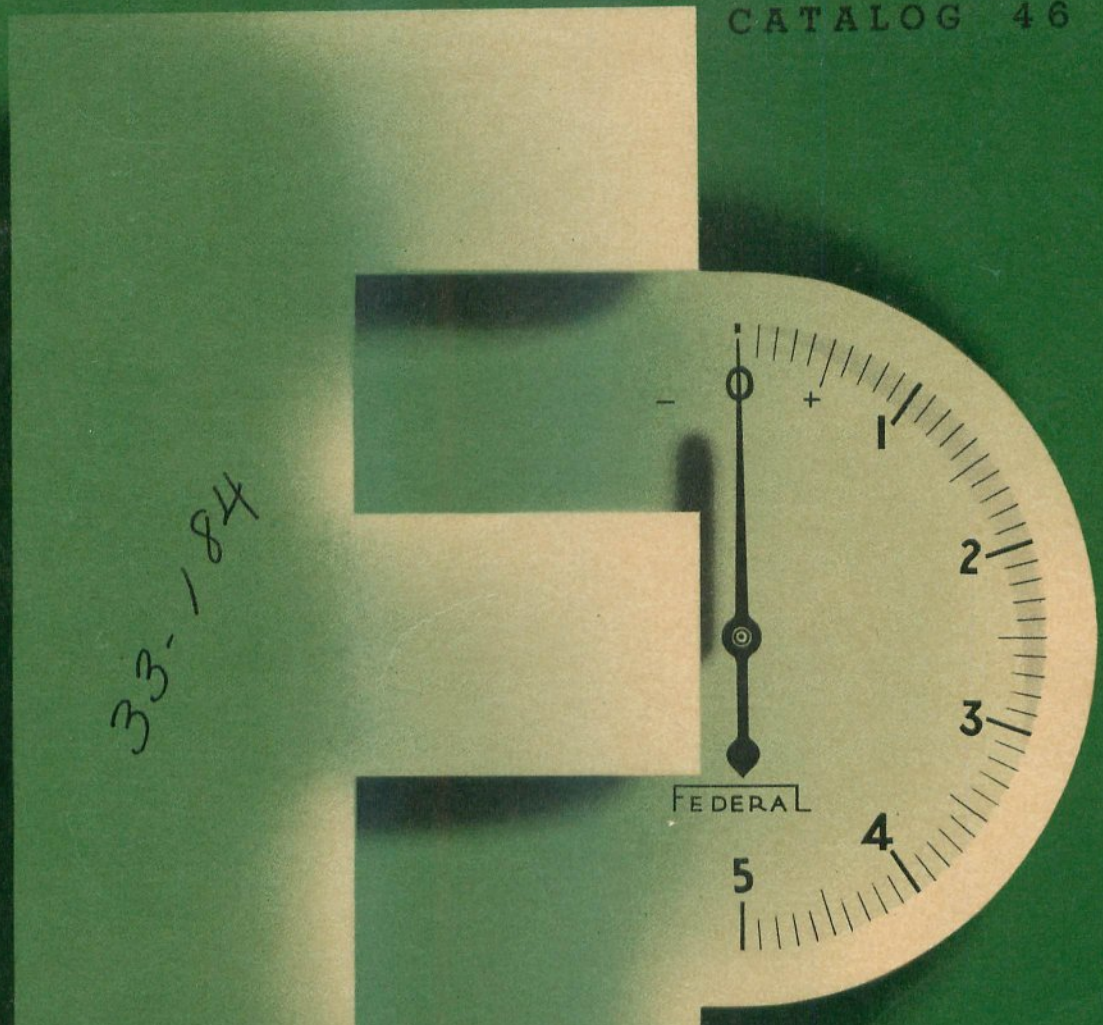
CATALOG 46

33-184



PRECISION MEASURING INSTRUMENTS

by

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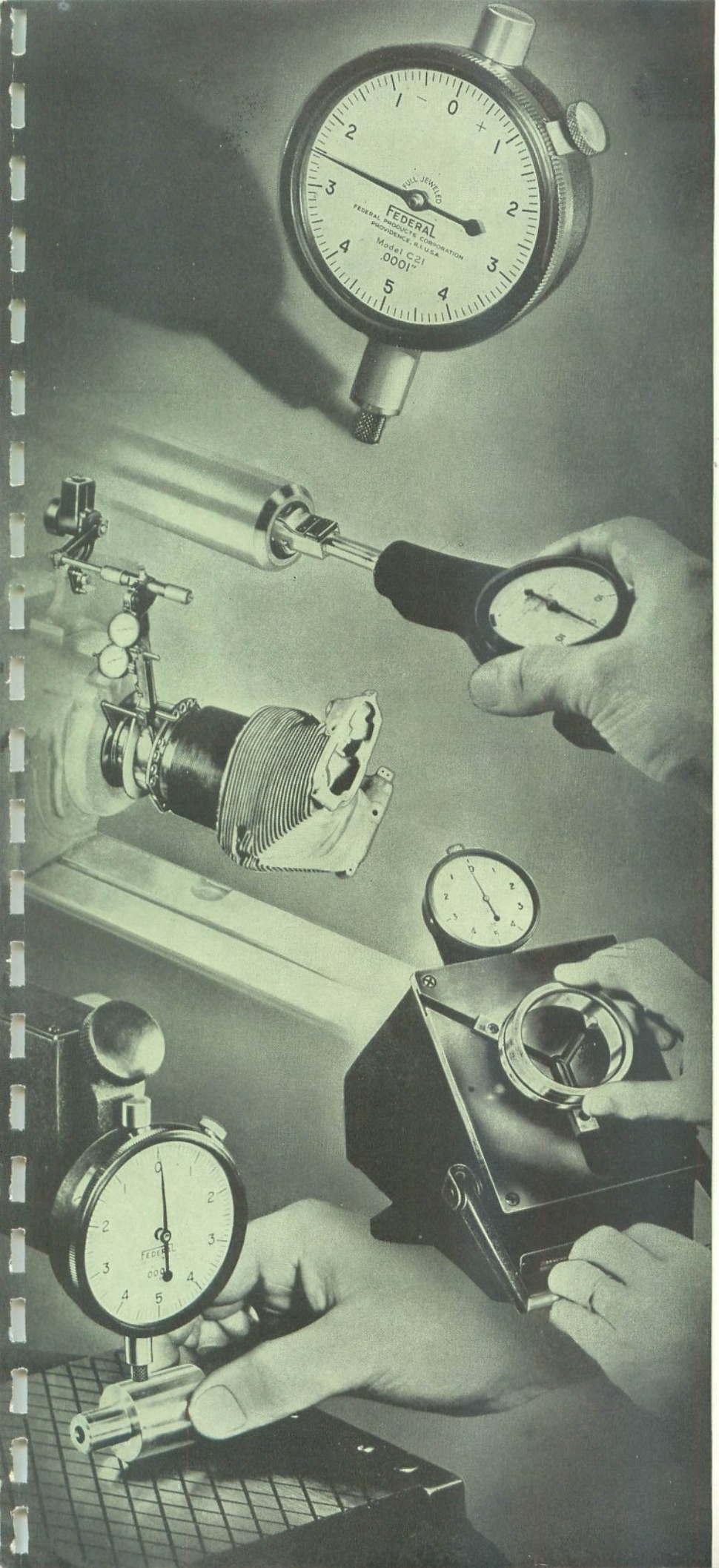

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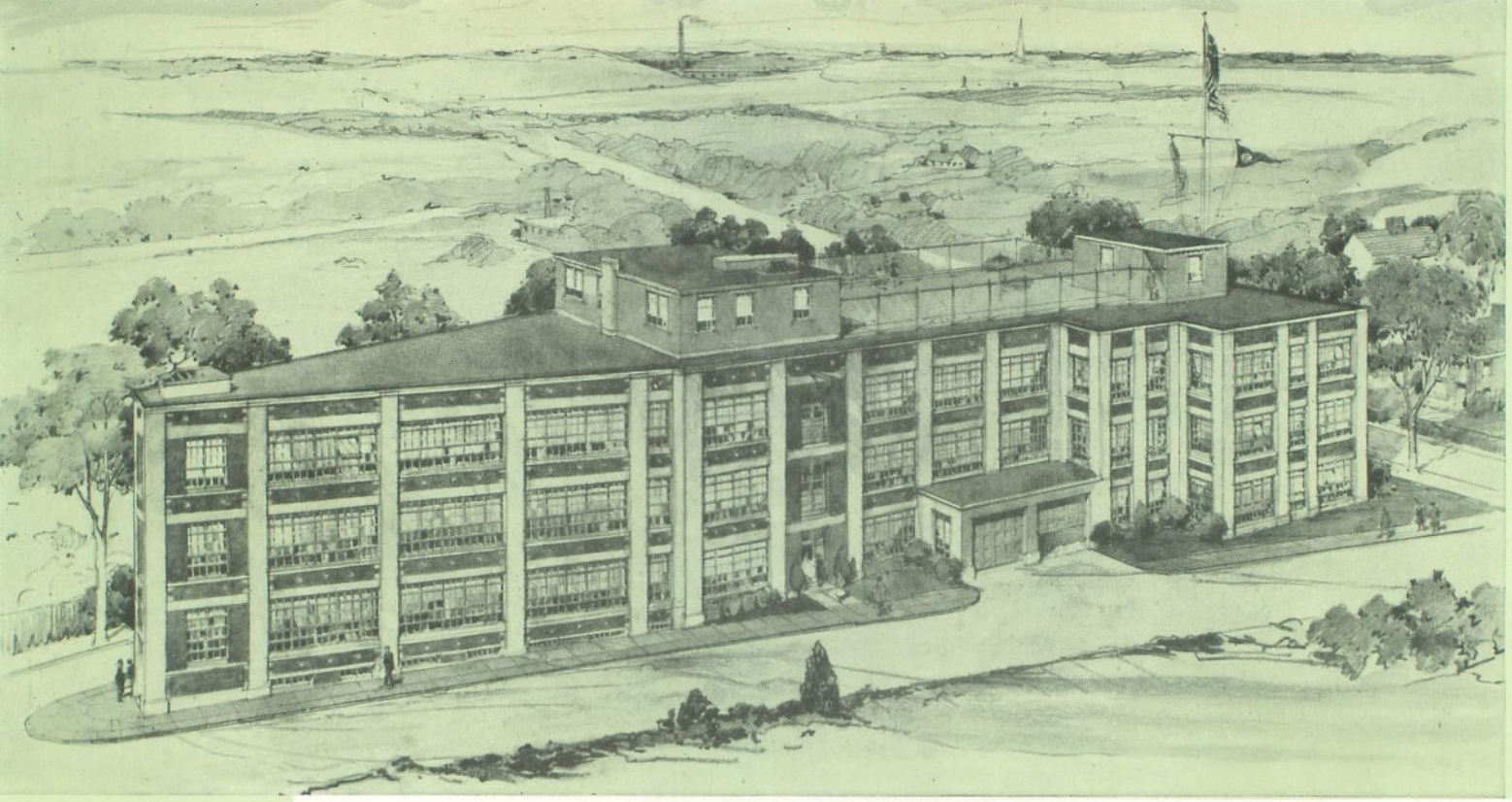
DIAL INDICATORS AND DIAL GAGES

PRECISION INSTRUMENTS FOR MEASURING AND COMPARING LINEAR DIMENSIONS



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DIAL INDICATOR GAGES

Listed by Model Number

Model No.	*Gage Name*	*Page*
20P	Thickness, Pocket	45
22P	Thickness, Portable	46
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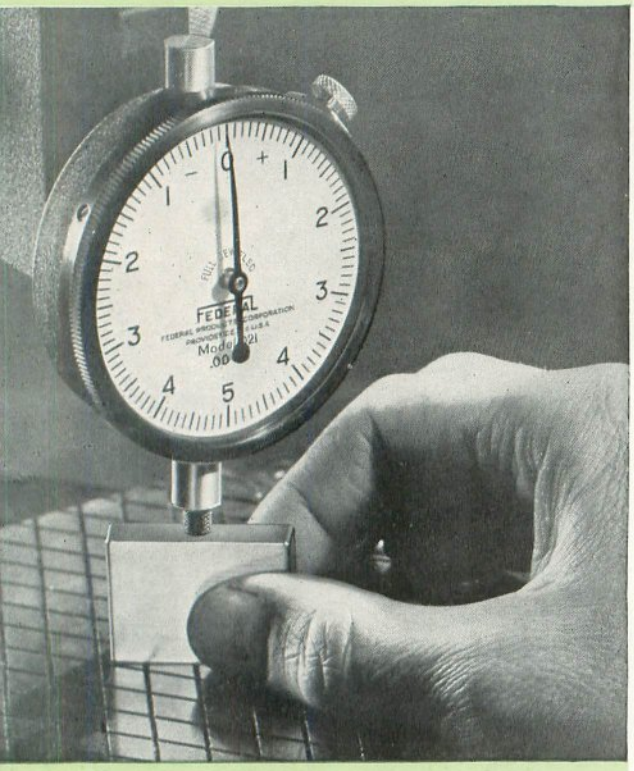
SPECIAL DESIGN SERVICE



DEPENDABLE PRECISION IS ASSURED BY THE SENSITIVITY OF THE FEDERAL LOW-FRICTION MOVEMENT

DEPENDABLE ACCURACY is, of course, the first and most important requirement of a precision measuring instrument. Regardless of how conveniently or quickly a workpiece is inspected, the inspection is of no value if it is not definitely precise. The instrument used in making the inspection must precisely and repeatedly show the inspector the variation in the workpiece dimension.

Therefore, a Dial Indicator must be immediately sensitive to any variation in the dimension. It must magnify the variation with a minimum of loss caused by internal friction, lost motion or pressure within.

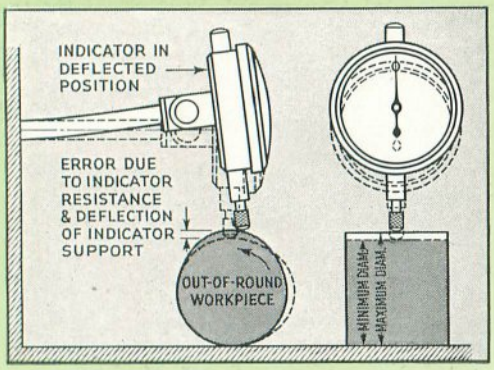
That is why Federal introduced its Low-Friction, Full-Jeweled Movement which has met with such great success. Federal was the first to realize that the use of jewels for *all* bearings in the movement would reduce internal friction to a minimum and give the highest degree of accuracy and sensitivity; and the continuing success of Federal Full-Jeweled Indicators testifies to the soundness of this important feature.

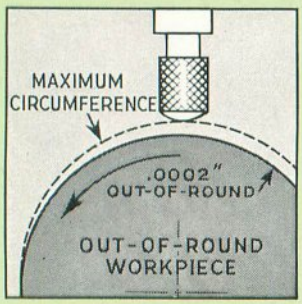
ADVANTAGES obtained by the use of this Low-Friction Indicator are its definite "repeat" readings, or its fidelity in showing the same amount of variation each time it compares the same dimension of the same piece.

CONTACT POINT responds immediately in either direction, up or down, and its movement is magnified with a minimum of friction, to the Indicator hand. Lost motion in transferring this motion is avoided by precisely cut gears, precisely set jewel bearings and a self-contained unit movement which enables precise alignment.

CONTACT PRESSURE of a Federal Low-Friction Indicator is exceptionally low. Liability for distortion of flexible workpieces or marring of the surface of soft materials is avoided. Deflection of holding rods and brackets used to support the Indicator is obviated.

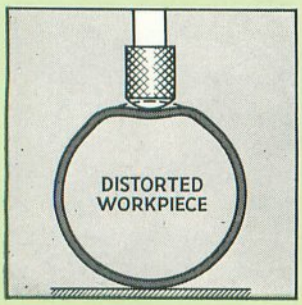
QUICK SENSITIVITY of this Indicator enables the contact point to adjust itself with equal fidelity to a sudden or to a gradual change in the dimension. Inertia does not delay the adjustment to the new position.


INDICATOR IN DEFLECTED POSITION
ERROR DUE TO INDICATOR RESISTANCE & DEFLECTION OF INDICATOR SUPPORT
OUT-OF-ROUND WORKPIECE
MINIMUM DIAM.
MAXIMUM DIAM.



IMPORTANCE OF SENSITIVITY—A Dial Indicator which is *not* sensitive will fail to give accurate readings if the Indicator is not rigidly supported.

INTERNAL RESISTANCE or "stickiness" will not allow an Indicator to follow slight variations in dimensions, nor quickly enough if the inspection operation is conducted speedily.



HEAVY CONTACT PRESSURE will easily distort a thin walled or delicate workpiece. The Indicator contact should touch the work *lightly* yet *positively*.

THE IMPROVED FEDERAL DIAL INDICATOR

Federal Dial Indicators maintain an outstanding position in precision measuring because of the constant anticipation of the precise demands placed upon them. Constant study and design naturally results in improvements. The unit construction principle of the movement still persists because of its basic efficiency of design. Nevertheless, improvements in detail design and construction are now made available in the Improved Federal Dial Indicator. These improvements are offered in anticipation of your demands for greater performance in precision measuring.

FEATURES OF THE IMPROVED MOVEMENT

BETTER PROPORTIONED GEARS — revised elevation and location of the gears on their staffs enables more positive mounting of the gears with less danger of loosening. Greater strength in the rack gear of the One and of the Two movement is obtained because of its new and larger size.

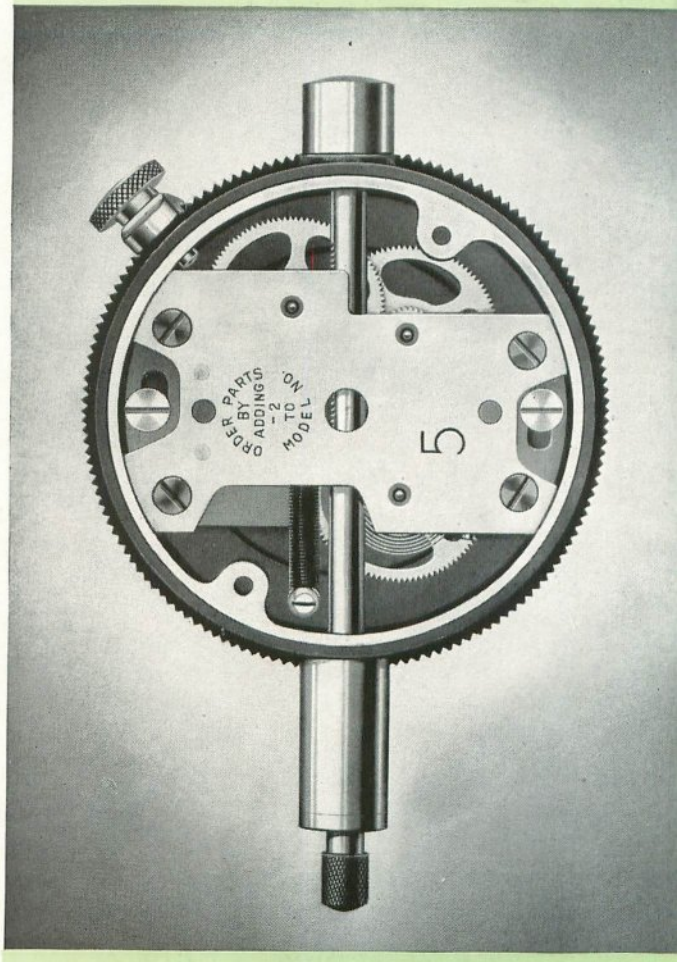
IMPROVED PINION BEARING — The bracket supporting this bearing has been enlarged so that it is now jeweled. The method of positioning the bracket has been improved and it is held in place with stronger screws. This means more precise tooth contact and more rigid support.

MORE ACCURATE ALIGNMENT — of the gear bearings in the top and bottom plate is insured by improved manufacturing methods.

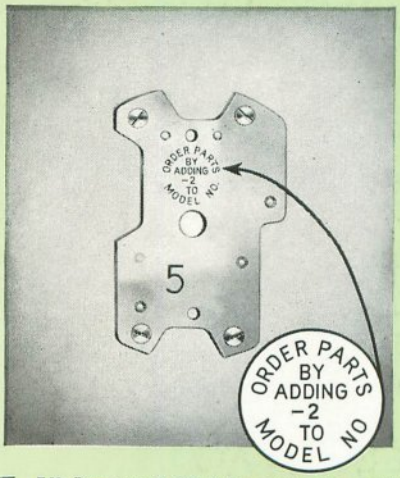
GREATER STRENGTH — in the larger rack slide screws — holds the slide more positively.

ELIMINATION OF DISTORTION — within the movement is due to improved means of attaching the top and bottom plates together. Better alignment also is obtained and bearing friction further reduced.

MORE POSITIVE MOVEMENT SETTING — Accuracy of the movement is improved by providing a more positive seat for the bottom plate. There is also greater latitude in adjusting the movement with the rack spindle.



THE UNIT CONSTRUCTION of the movement is retained because of its basic efficiency.



NOTE. All Improved Models carry the suffix -2 on the movement plate *inside* the case.

WHEN ORDERING duplicate Improved Dial Indicators or replacement parts, add this suffix -2 to the Indicator Model No. which appears on the dial, e.g. C5M-2.

FEDERAL DIAL INDICATORS

REGULAR TYPE

ENGLISH, METRIC and LONG RANGE

A.G.D. Specifications . . . Full Jewel, Regular Jewel or Plain Bearings . . . Balanced or Continuous Dials with or without Revolution Counter and Double Dials

BALANCED DIAL CONTINUOUS DIAL

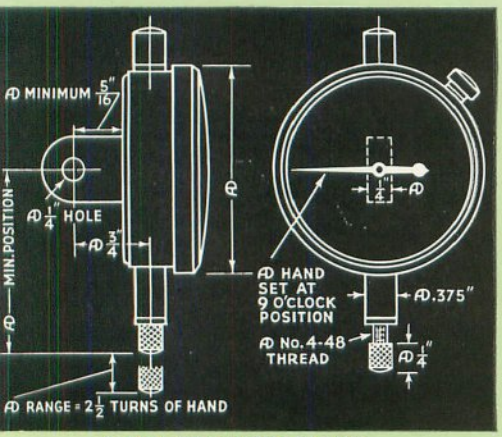
Any Indicator can be furnished with either Balanced or Continuous numbered dials.

Dials at right show the five sizes of Indicators

A Size
1 1/8" Dia.

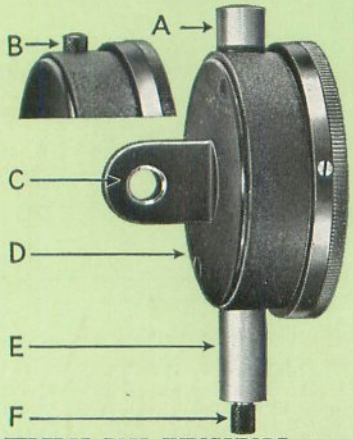
B Size
1 11/16" Dia.

C Size
2 1/4" Dia.



A.G.D. SPECIFICATIONS

(See Page 18 for Federal Indicator dimensions)



FEDERAL DIAL INDICATORS are regularly furnished *Enclosed* (A), *Exposed* (B), as illustrated above, upon request. The latter furnishes a means for lifting the contact point. Specify which is desired. This applies to all Regular Type Indicators, English, Metric and Long Range except A and E sizes.

GENERAL SPECIFICATIONS

All Federal, Regular Type, Indicators, with the exception of the Model A6Q, conform with the dimensions and specifications standardized by the American Gage Design Committee, hereafter referred to as A.G.D. These standards were set up in the interest of great accuracy and interchangeability. A.G.D. specifies that the Indicator range shall be determined by 2½ revolutions of the hand, and that latter start at 9 o'clock position. See drawing at left. The symbol "AD" used with a specification indicates that it is an American Gage Design standard as recorded in Commercial Standard Bulletin (Emergency) CS (E) 119–45.

IMPROVED MOVEMENT: All Indicators listed here, except Model A6Q, have the new FEDERAL Improved Movement described on previous page.

DIAL: Furnished with graduations numbered either Continuous or Balanced (+ and —). See small illustrations above at left of A Size Indicator. Dials are graduated in a variety of graduations. See table at right and following pages.

RANGE: A.G.D. standards specify 2½ revolutions of Indicator hand. Table at right lists range in inches and millimeters.

LONG RANGE INDICATORS: These also have A.G.D. specifications, except in range.

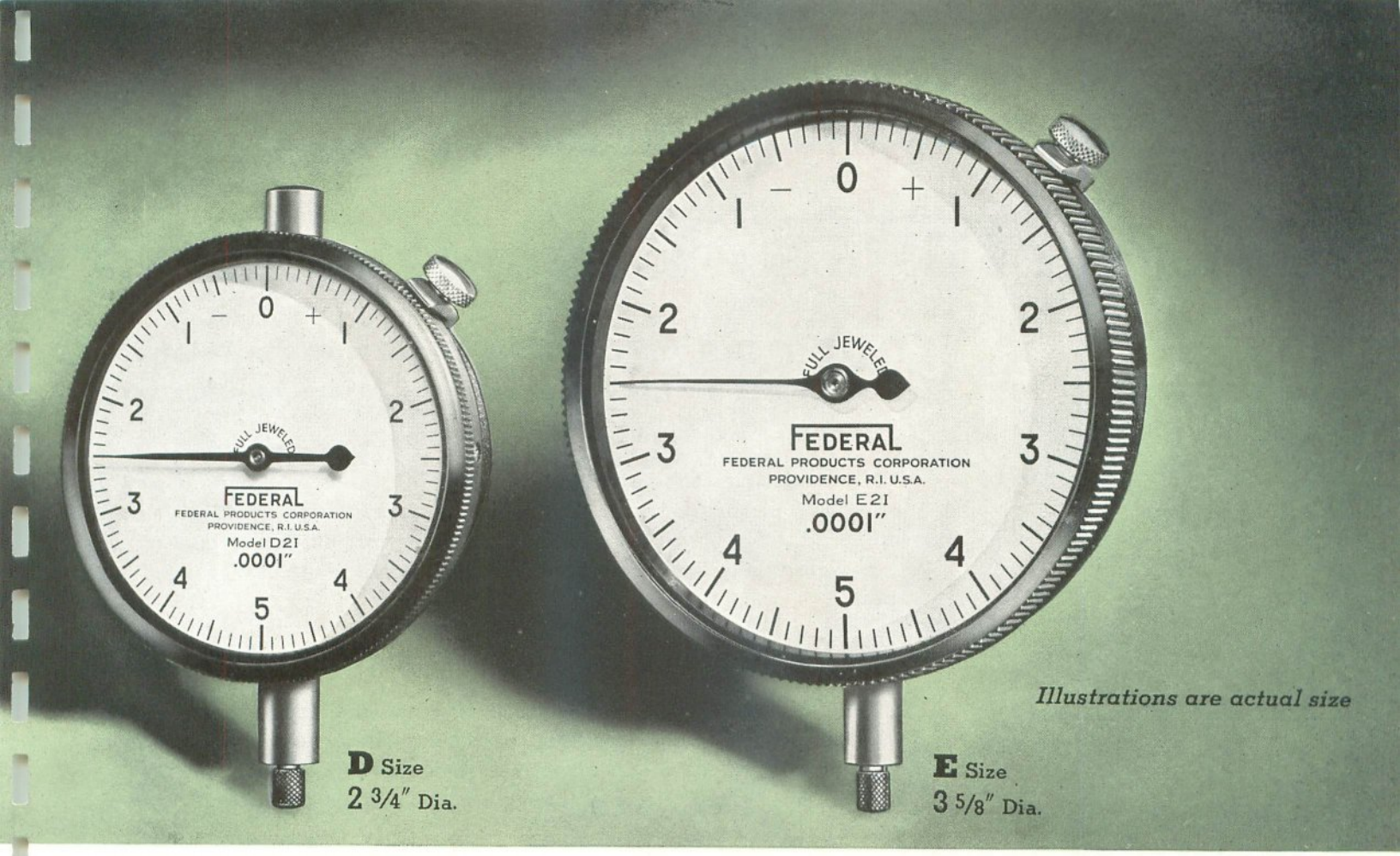
BEARINGS: Full-Jewel Low-Friction, Regular Jewel or Plain Bearing are optional. See page 4 for explanation of Full-Jewel Low-Friction advantages.

STEM (E): .375" is the A.G.D. standard diameter. Model A6Q has No. 0 taper, 5/32" diameter at top.

CONTACT POINT (F): A.G.D. standard point is ¼" long, of hardened steel. For other materials, sizes and shapes, see page 15.

BACK (D): A.G.D. standard bracket (C) is on center of back and has ¼" hole. See page 15 for other types. A6Q has post bracket 7/32" dia. x 5/16" long.

METRIC INDICATORS: All have same specifications as above including the A.G.D. specification that range be determined by 2½ revolutions of the hand. The dials only are different.



D Size
2 3/4" Dia.

E Size
3 5/8" Dia.

Illustrations are actual size

REGULAR TYPE INDICATOR MODELS*

ENGLISH Graduations.

SPECIFICATIONS				SIZES and MODELS				
GRADUATIONS		RANGE, Inches						
Value, Inches	Number of	One Rev of hand	A.G.D. Total	A 1 1/8" Diam.	B 1 11/16" Diam.	C 2 1/4" Diam.	D 2 3/4" Diam.	E 3 5/8" Diam.
.00005	160	.008	.008	See Super-Sensitive Model E1DB, *page 25*				
.0001	200	.020	.050	---	---	---	---	E3B
	100	.010	.025	---	B2I	C2I	D2I	E2I
	80	.008	.020	---	---	C1K	D1K	E1K
.00025	120	.030	.075	---	---	---	†D5G	†E5G
	80	.020	.050	---	B3K	C3K	†D3K	†E3K
	40	.010	.025	---	B2Q	C2Q	†D2Q	---
.0005	100	.050	.125	---	B7I	C7I	D7I	†E7I
	80	.040	.100	---	B6K	C6K	D6K	---
	60	.030	.075	---	B5M	C5M	D5M	E5M
	40	.020	.050	---	B3Q	C3Q	†D3Q	†E3Q
.001	100	.100	.250	---	B8I	C8I	D8I	E8I
	50	.050	.125	---	B70	C70	D70	†E70
	40	.040	.100	---	---	C6Q	†D6Q	---
	40	.040	.040§§	A6Q	---	---	---	---
	20	.020	.050	---	B3W	C3W	D3W	†E3W

LONG RANGE INDICATORS

.0001	200	.020	.400§§	---	---	---	---	E3BS
.001	100	.100	1.000§§	---	---	C8IS	D8IS	---

†*These models are available, but not stocked.*
§ *Not A. G. D. Range.*

METRIC Graduations.

SPECIFICATIONS				SIZES and MODELS				
GRAD'S		RANGE, mm.						
Value, mm.	Number of	One Rev of hand	A.G.D. Total	N 1 1/8" Diam.	O 1 11/16" Diam.	P 2 1/4" Diam.	Q 2 3/4" Diam.	R 3 5/8" Diam.
.001	200	.200	.200	See Super-Sensitive Model R1BB, *page 25*				
.002	100	.200	.500	--	--	P1I	Q1I	R1I
.005	100	.500	1.250	--	--	P3I	Q3I	--
.010	100	1.000	2.500	--	O6I	P6I	Q6I	R6I
	100	1.000	1.000§	N6I	--	---	---	--

LONG RANGE INDICATORS

.010	100	1.000	25.00§	--	--	---	Q6IS	--

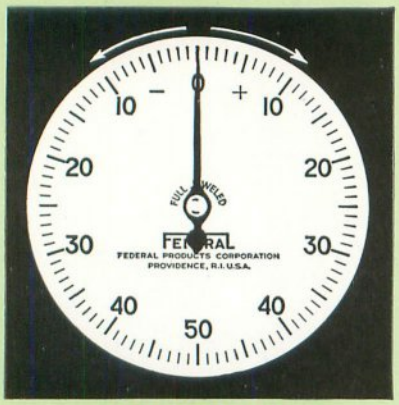
All above Metric Indicators are available, but not stocked.
§ *Not A. G. D. Range.*

**See other types:*

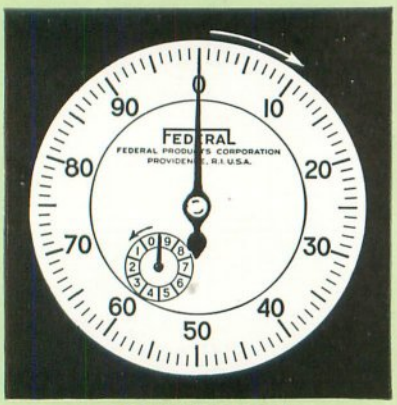
CUSHIONED MOVEMENT
PERPENDICULAR INDICATORS
SUPER-SENSITIVE INDICATORS
UNIVERSAL TESTMASTER

See following pages for Dial illustrations

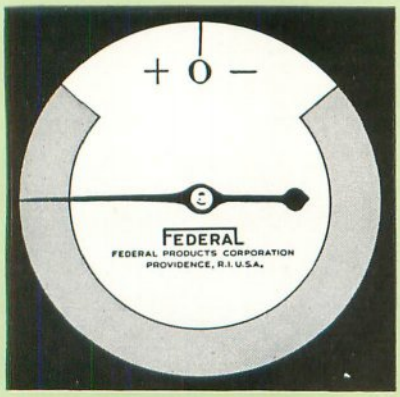
DIALS for FEDERAL INDICATORS



BALANCED DIAL
Without Revolution Counter
and Double Dial



CONTINUOUS DIAL
With Revolution Counter and
Double Dial



SPECIAL DIAL

SELECT **GRADUATION that suits the Tolerance; SIZE that suits the Space and Visibility**

All Indicator Dials can be furnished in either of two types, Balanced, as illustrated on following pages, or Continuous. See below for explanation. All dials on the following pages are classified according to the value of their graduations. Select the graduation according to the tolerances you are required to inspect.

BALANCED DIALS have the graduations numbered consecutively on both sides of zero. They are used as comparators for precisely *comparing* the dimensions of work pieces with the specified dimensions. Revolution Counters and Double Dials are sometimes required on Balanced Dials. See second paragraph below.

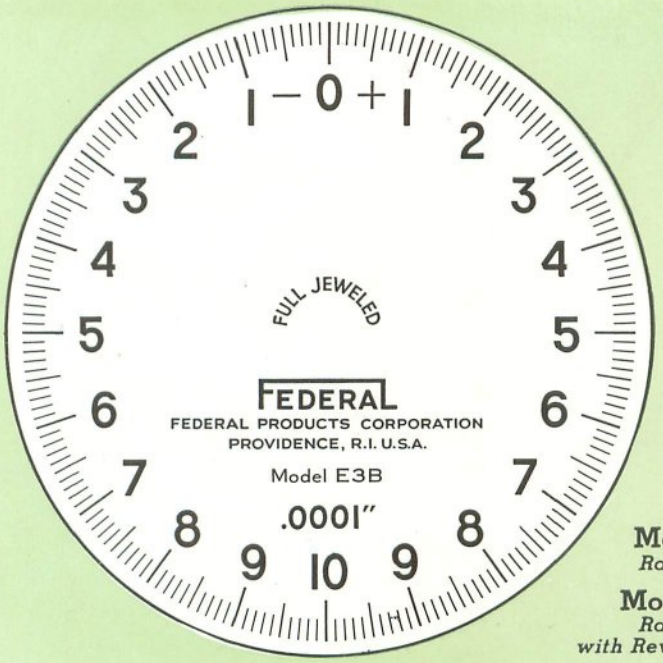
CONTINUOUS DIALS have the graduations numbered continuously around the dial. The value of the graduations is exactly the same as those on Balanced Dials. Continuous Dials are used most frequently for *direct measuring*, as for measuring thickness, elongation or any unknown distance.

REVOLUTION COUNTER AND DOUBLE DIAL, second illustration from top, are of great assistance on all *Long Range* Indicators. The Revolution Counter counts off the revolutions of the large hand and so facilitates reading the total measurement. *The Revolution Counter is also used on Balanced Dials* to tell the user *which* revolution of the large hand he is reading. This prevents mistakes in reading the Indicator. The Double Dial enables one to set zero at any required position independent of the Revolution Counter. Revolution Counter and Double Dial are optional except that they are always furnished on Long Range Indicators wherever listed at no extra charge. On Regular Type Indicators they are $2.00 extra.

SPECIAL DIALS can be furnished, simplified by special markings or colored sections in place of graduations for less skilled inspection, for greater speed in reading and for sorting material to standardized dimension specifications. Also, special graduations, having values other than the conventional linear divisions, can be supplied. The dial illustrated very simply and emphatically indicates when a dimension is too large or too small. When hand stops within open section the work is OK. On quantities large enough to warrant the extra expense, the dials will be marked with your firm's name or trademark. This helps to prevent theft.

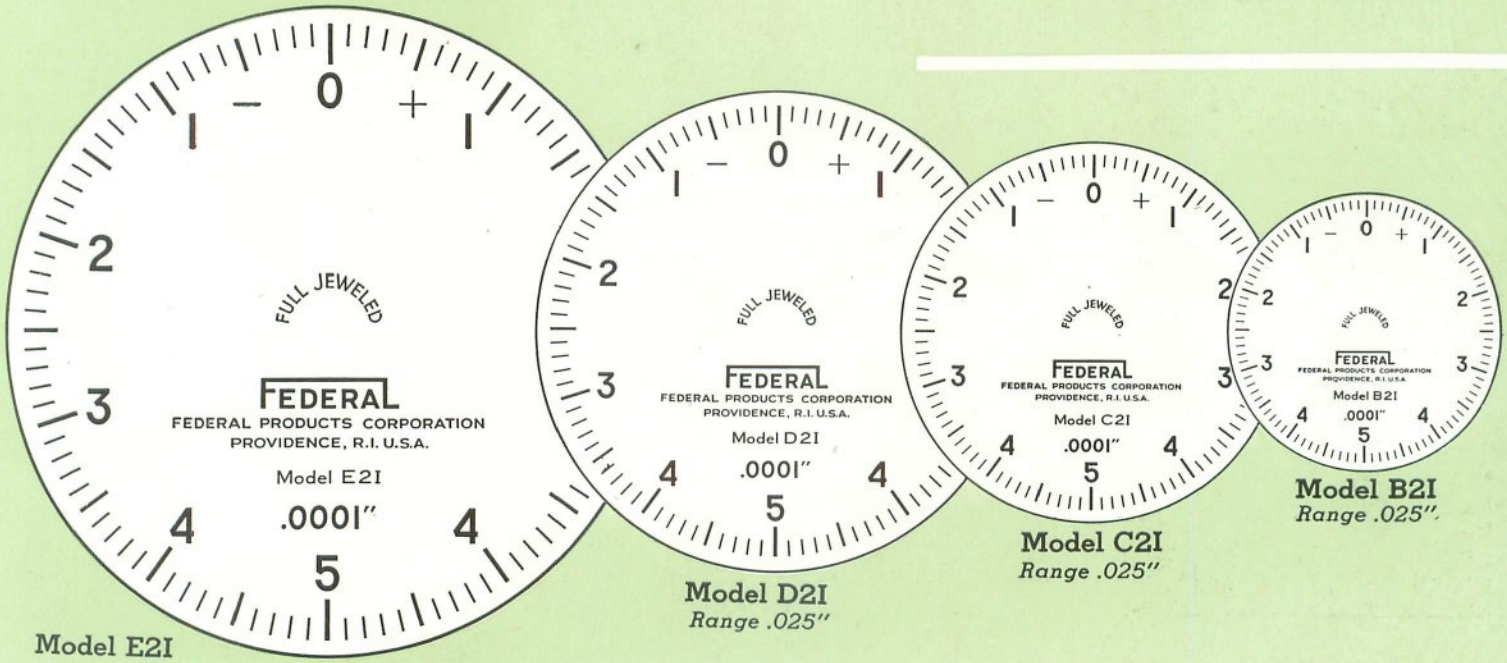
.0001 Graduations

This Indicator can be furnished with a range of .400" Model E3BS, but in general we do not recommend long ranges on Indicators graduated in tenths of thousandths because of the accumulation of inaccuracies over the long range. For greatest accuracy use a range as short as possible.



Model E3B
Range .050"

Model E3BS
Range .400"
with Revolution Counter

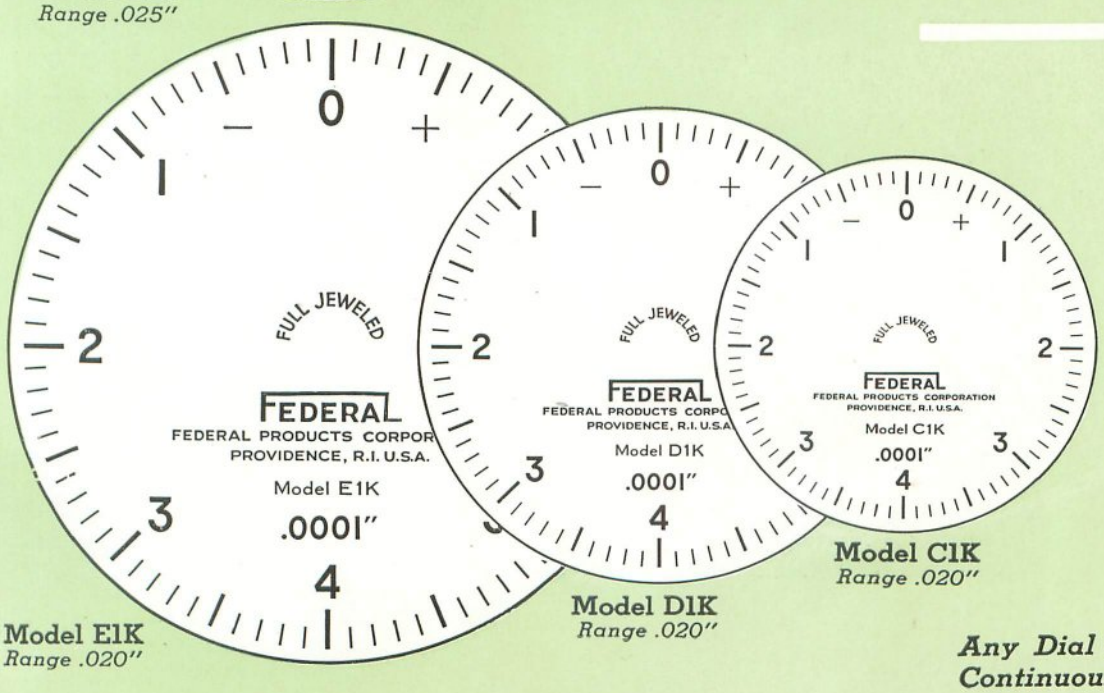


Model E2I
Range .025"

Model D2I
Range .025"

Model C2I
Range .025"

Model B2I
Range .025"



Model E1K
Range .020"

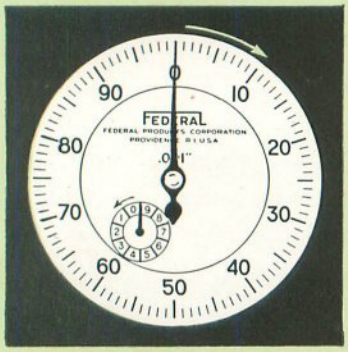
Model D1K
Range .020"

Model C1K
Range .020"

These Indicators have a slightly greater magnification and are slightly more sensitive than those above.

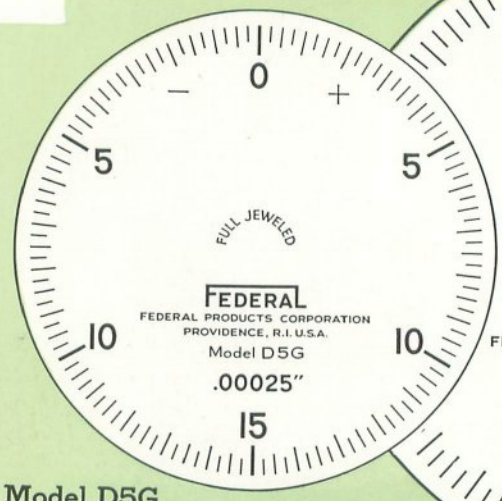
Any Dial can be furnished with Continuous numbered graduations

.00025 Graduations

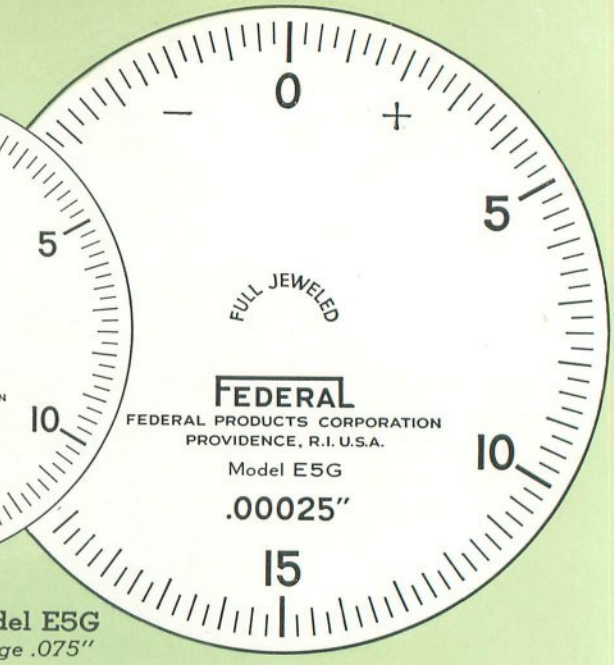


CONTINUOUS DIAL and REVOLUTION COUNTER

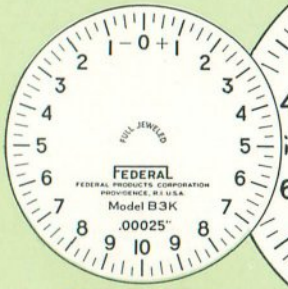
Counter is used with Continuous Dials for making direct measurements such as thickness, elongation, etc. Revolution Counter counts the revolutions of the large hand.



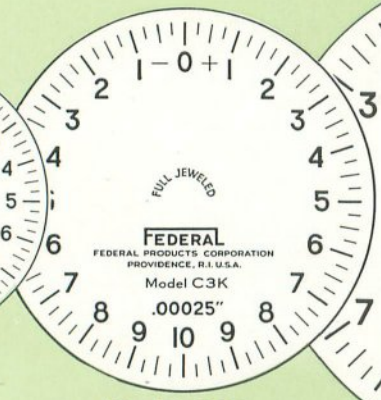
Model D5G
Range .075"



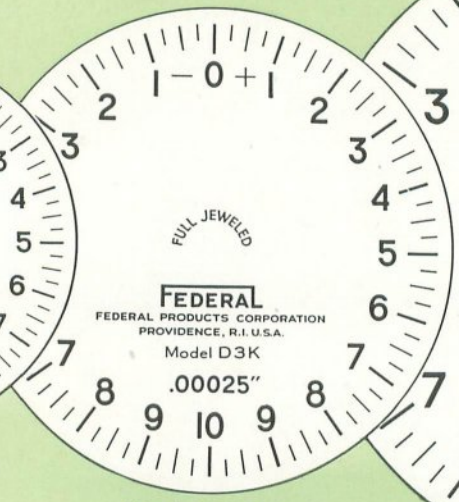
Model E5G
Range .075"



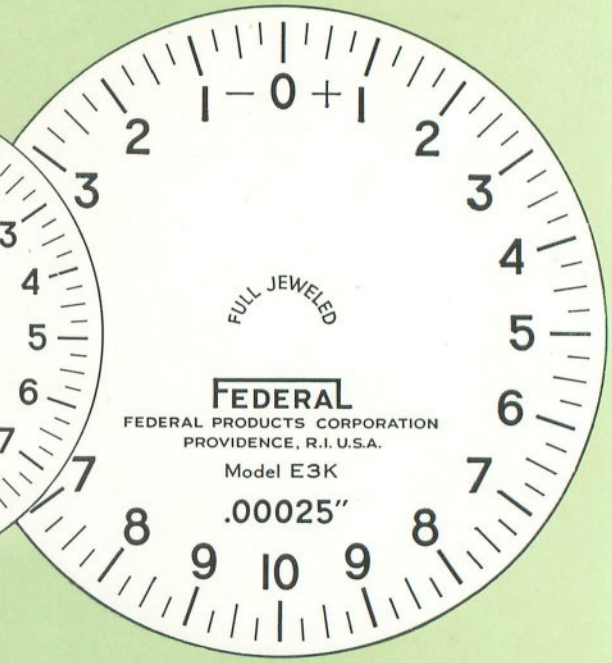
Model B3K
Range .050"



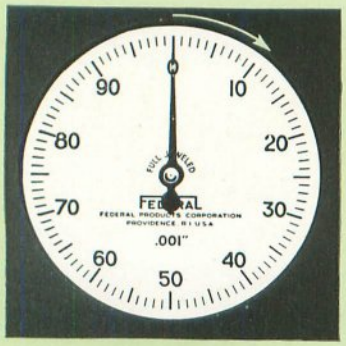
Model C3K
Range .050"



Model D3K
Range .050"

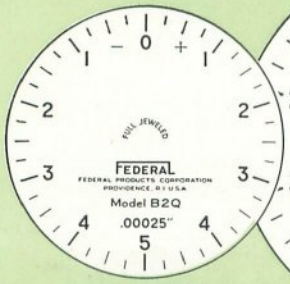


Model E3K
Range .050"

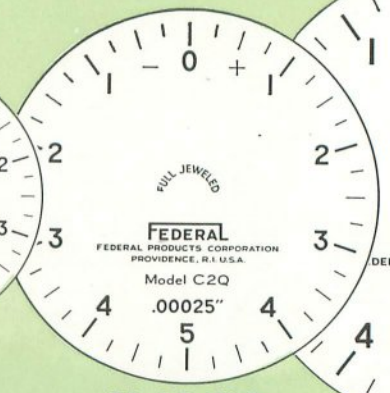


CONTINUOUS DIALS

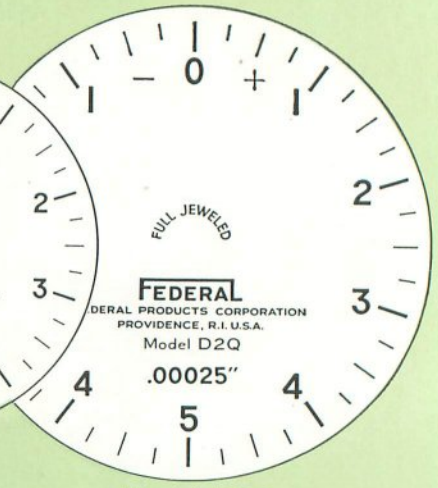
Furnished whenever desired in place of Balanced Dials shown on these pages.



Model B2Q
Range .025"



Model C2Q
Range .025"

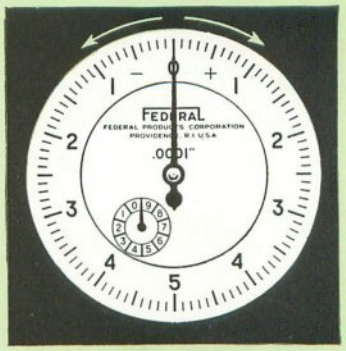


Model D2Q
Range .025"

NOTE

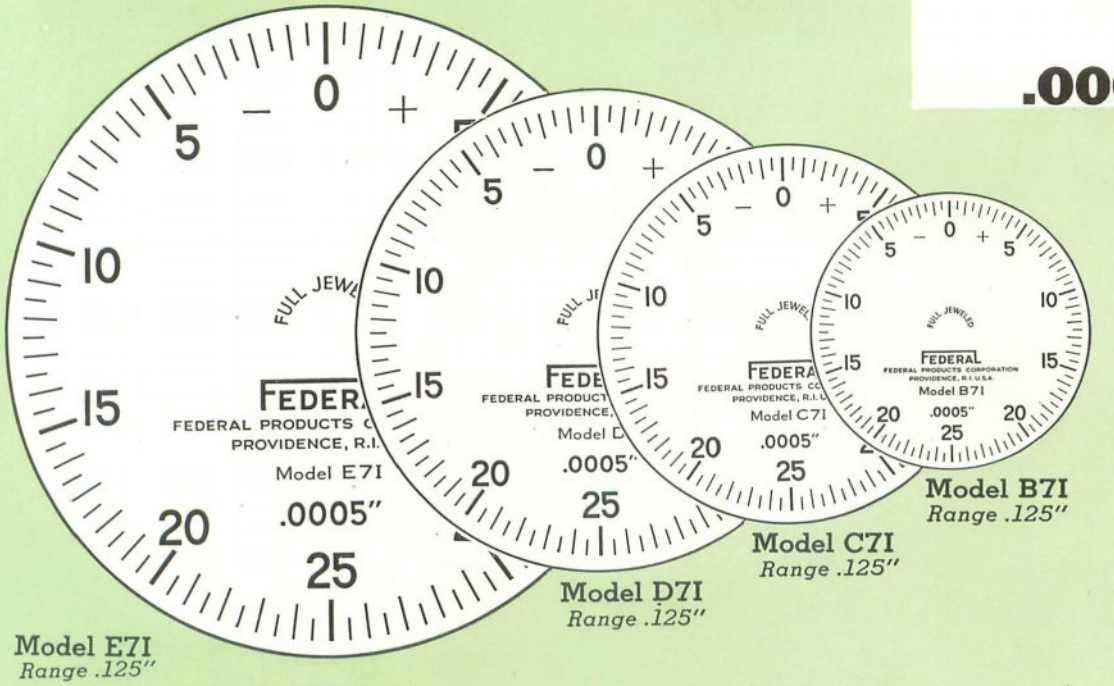
Any Dial can be furnished with Continuous numbered graduations

.0005 Graduations



BALANCED DIAL and REVOLUTION COUNTER

Counter is used on Balanced Dials to tell the user which revolution of the large hand he is reading. This prevents mistakes in reading the indicator.

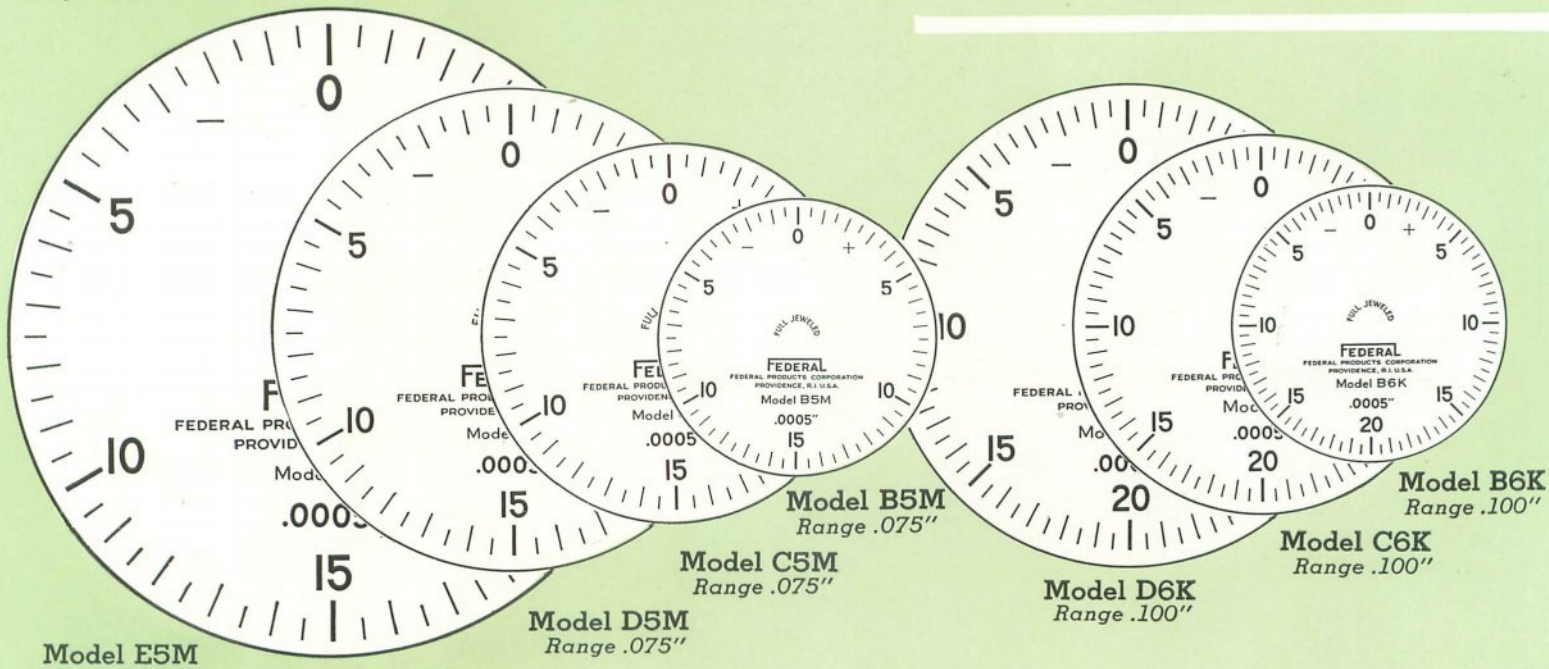


Model E7I
Range .125"

Model D7I
Range .125"

Model C7I
Range .125"

Model B7I
Range .125"



Model E5M
Range .075"

Model D5M
Range .075"

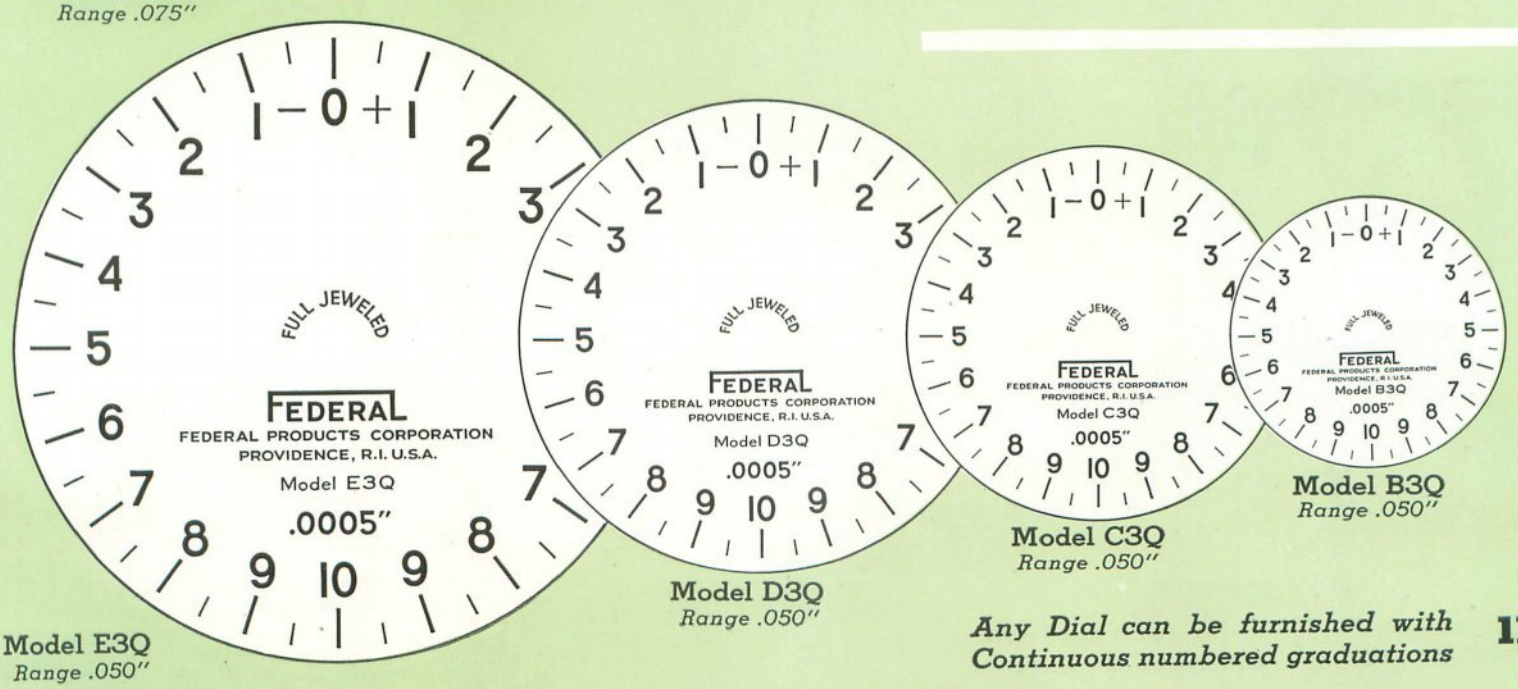
Model C5M
Range .075"

Model B5M
Range .075"

Model D6K
Range .100"

Model C6K
Range .100"

Model B6K
Range .100"



Model E3Q
Range .050"

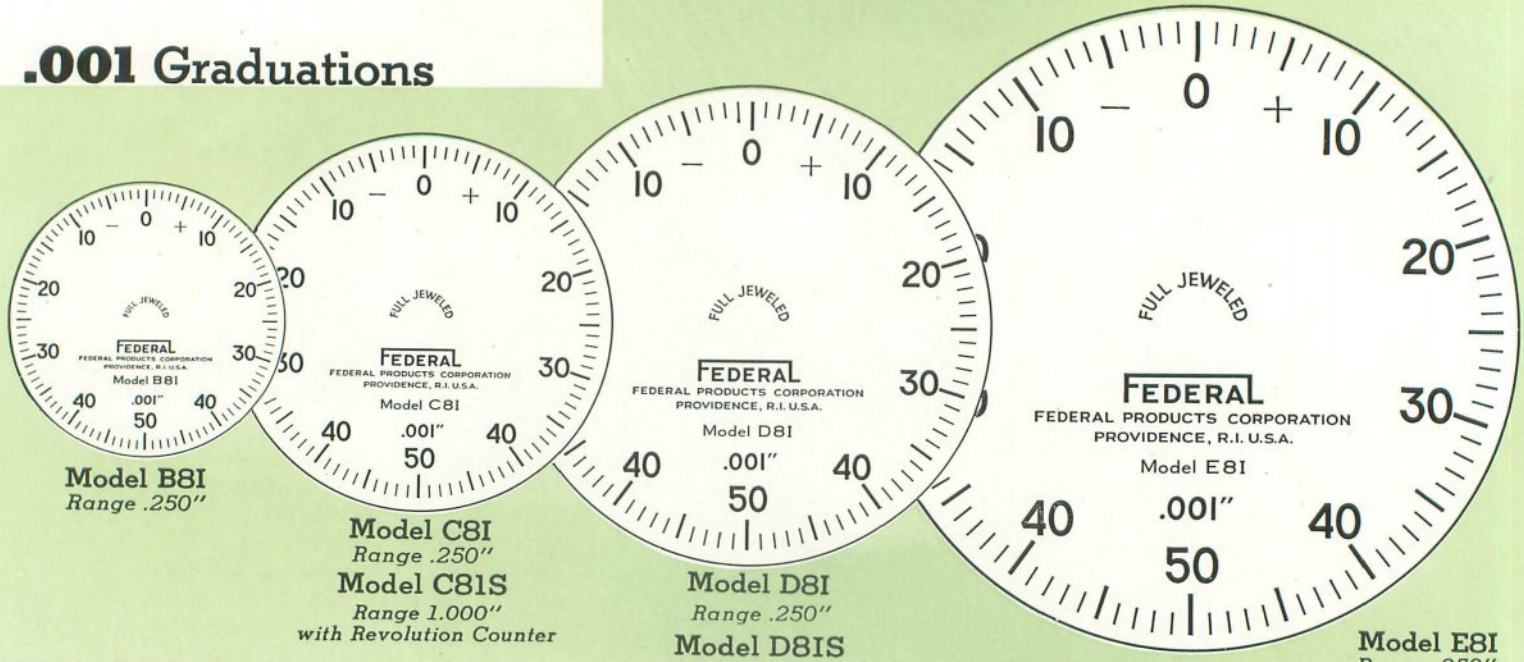
Model D3Q
Range .050"

Model C3Q
Range .050"

Model B3Q
Range .050"

Any Dial can be furnished with Continuous numbered graduations

.001 Graduations



Model B8I
Range .250"

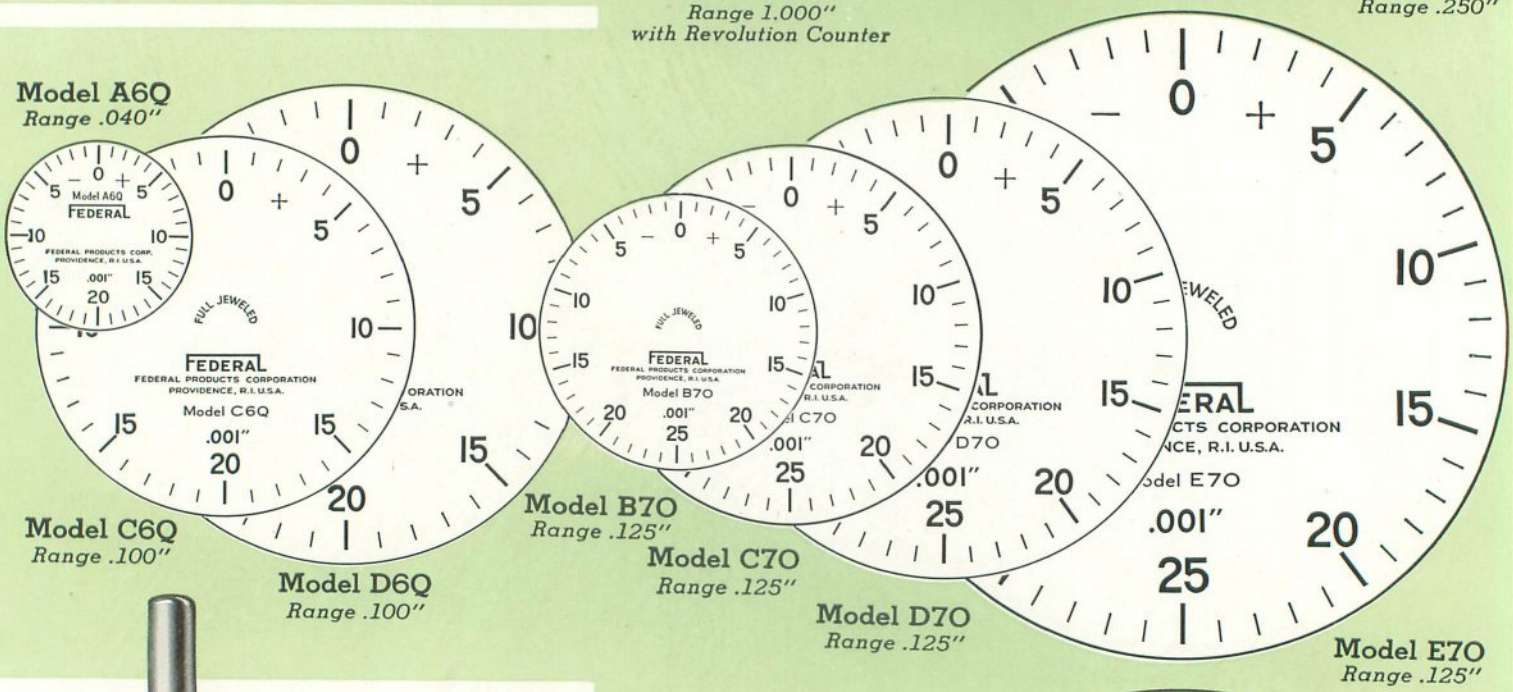
Model C8I
Range .250"

Model C81S
Range 1.000"
with Revolution Counter

Model D8I
Range .250"

Model D81S
Range 1.000"
with Revolution Counter

Model E8I
Range .250"



Model A6Q
Range .040"

Model C6Q
Range .100"

Model D6Q
Range .100"

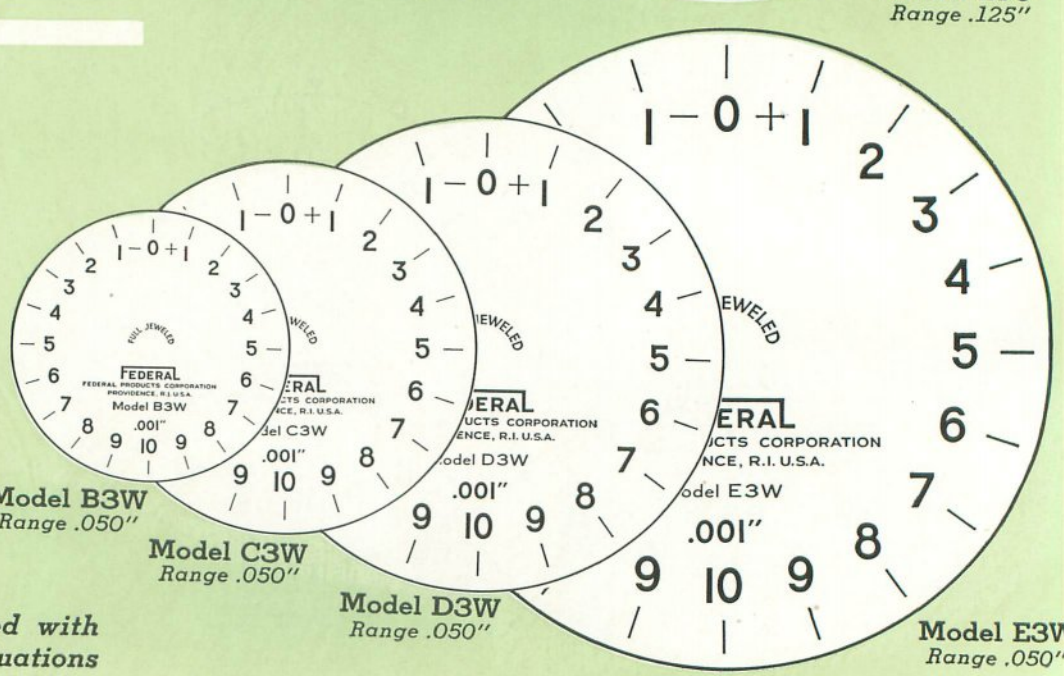
Model B7O
Range .125"

Model C7O
Range .125"

Model D7O
Range .125"

Model E7O
Range .125"

Long Range Indicators



Model B3W
Range .050"

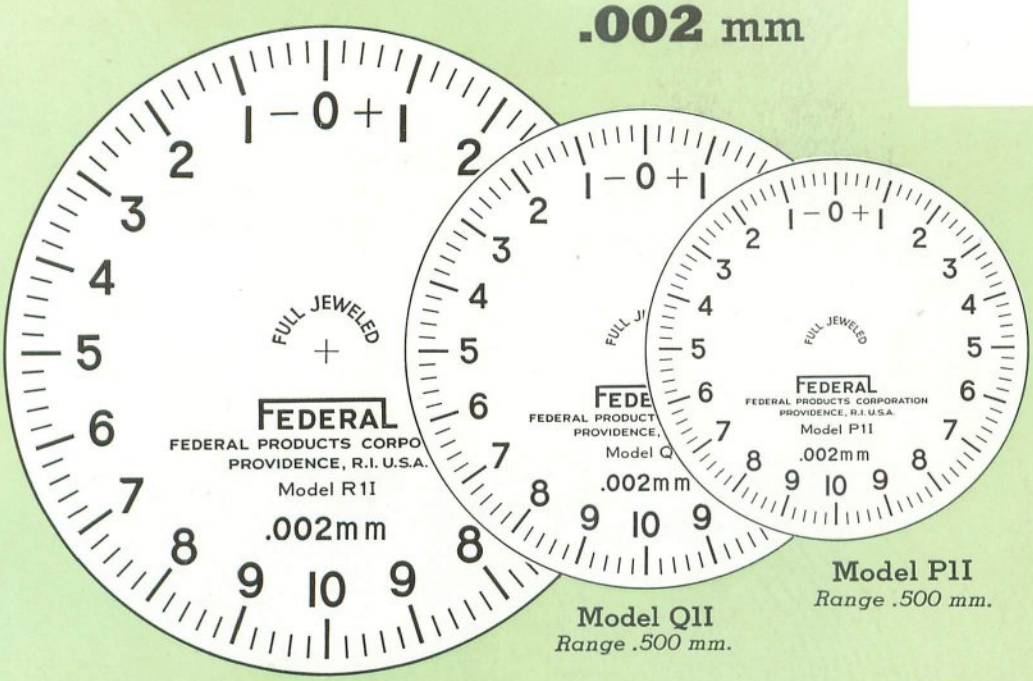
Model C3W
Range .050"

Model D3W
Range .050"

Model E3W
Range .050"

NOTE
Any Dial can be furnished with Continuous numbered graduations

.002 mm



Model R1I
Range .500 mm.

Model Q1I
Range .500 mm.

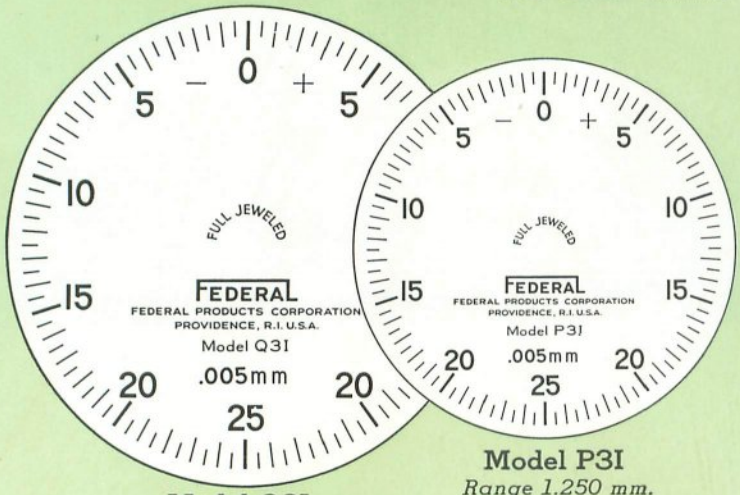
Model P1I
Range .500 mm.

.001 mm

Illustrated on page 25

For Metric Indicators graduated in .001 mm. see Super-Sensitive Indicators on page 25.

.005 mm



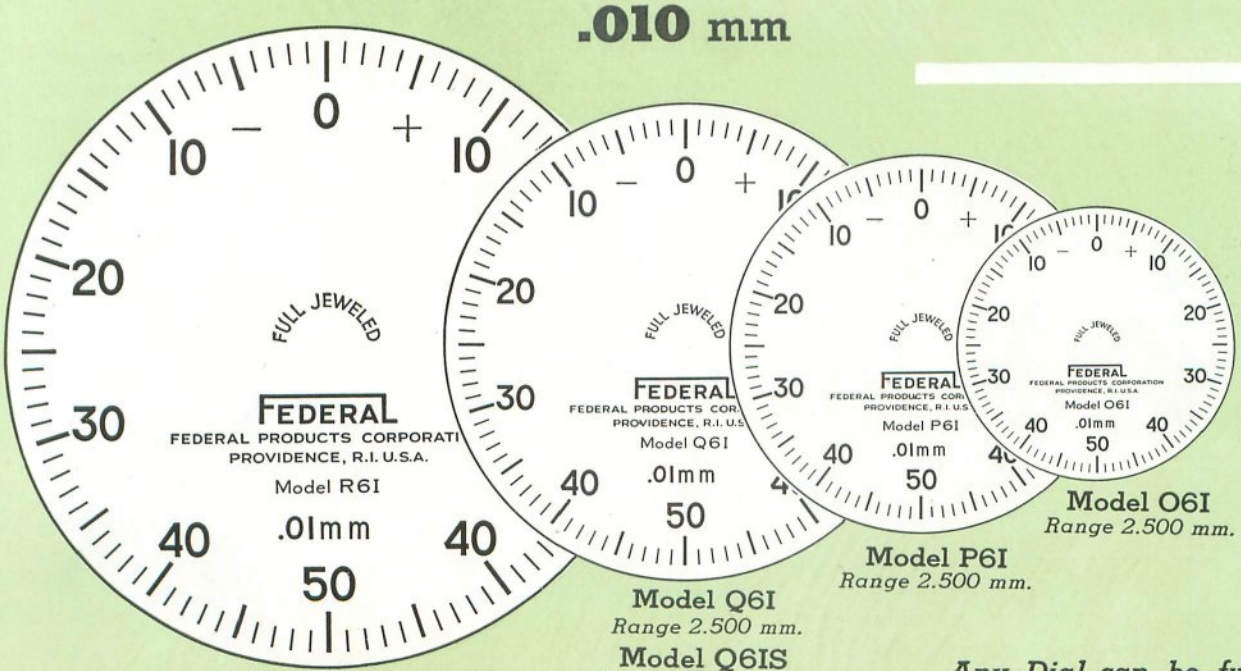
Model Q3I
Range 1.250 mm.

Model P3I
Range 1.250 mm.

METRIC INDICATORS

Except for the Dial Graduations and Ranges, the Metric Indicators have the same physical specifications and dimensions as the English Indicators. See pages 6 and 7 for additional specifications. They can also be furnished with Continuous Dials and with Revolution Counters and Double Dials the same as our regular English models.

.010 mm



Model R6I
Range 2.500 mm.

Model Q6I
Range 2.500 mm.

Model Q6IS
Range 25.000 mm.
with Revolution Counter

Model P6I
Range 2.500 mm.

Model O6I
Range 2.500 mm.

Model N6I
Range 1.000 mm.

Any Dial can be furnished with Continuous numbered graduations

DIMENSIONS

ENGLISH MODELS

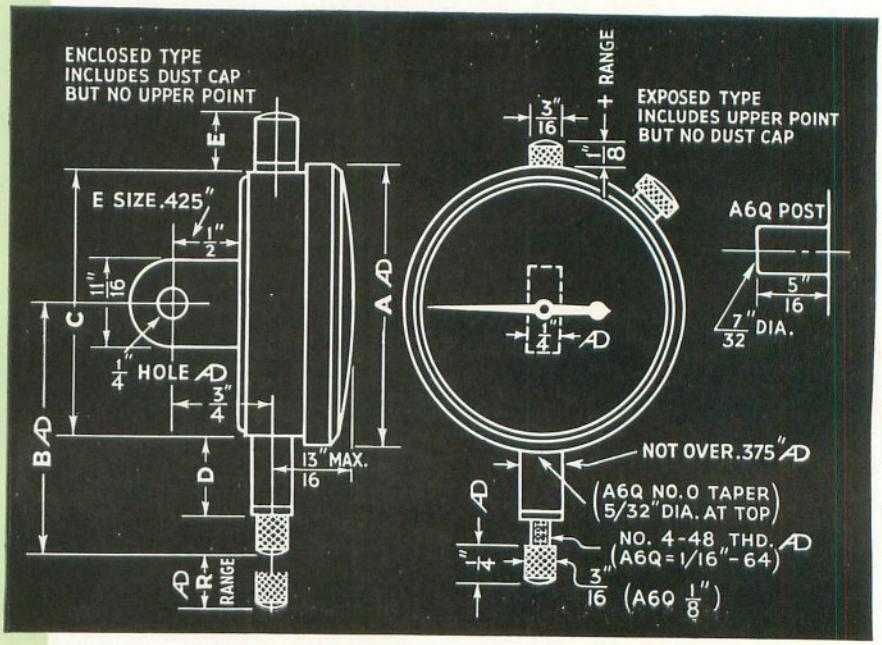
	MODEL	Range, R A.G.D. Dim.	A A.G.D. Dim.	B A.G.D Dim.	C	D	E
	A6Q	* .040″	* 1⅛″	* 1.322″	1⁷⁄₆₄″	.563″	No Cap
A.G.D. Group 1	B2I	.025″	1¹¹⁄₁₆″	1⅝″	1½″	⅝″	.437″
	B3K	.050″					
	B2Q	.025″					
	B7I	.125″					
	B6K	.100″					
	B5M	.075″					
	B3Q	.050″					
	B8I	.250″					
	B7O	.125″					
	B3W	.050″					
A.G.D. Group 2	C2I	.025″	2¼″	2″	2¹⁄₁₆″	²³⁄₃₂″	.437″
	C1K	.020″					
	C3K	.050″					
	C2Q	.025″					
	C7I	.125″					
	C6K	.100″					
	C5M	.075″					
	C3Q	.050″					
	C8I	.250″					
	C7O	.125″					
	C6Q	.100″					
	C3W	.050″					
	C8IS	* 1.000″	2¼″	2″	2¹⁄₁₆″	²³⁄₃₂″	1.125″
A.G.D. Group 3	D2I	.025″	2¾″	2⅛″	2½″	⅝″	.437″
	D1K	.020″					
	D5G	.075″					
	D3K	.050″					
	D2Q	.025″					
	D7I	.125″					
	D6K	.100″					
	D5M	.075″					
	D3Q	.050″					
	D8I	.250″					
	D7O	.125″					
	D6Q	.100″					
	D3W	.050″					
	D8IS	* 1.000″	2¾″	2⅛″	2½″	⅝″	1.125″
A.G.D. Group 4	E3B	.050″	3⅝″	2⁹⁄₁₆″	3⅜″	⅝″	†.031″
	E2I	.025″					
	E1K	.020″					
	E5G	.075″					
	E3K	.050″					
	E7I	.125″					
	E5M	.075″					
	E3Q	.050″					
	E8I	.250″					
	E7O	.125″					
	E3W	.050″					
	E3BS	* .400″	3⅝″	2⁹⁄₁₆″	3⅜″	⅝″	.6875″

METRIC MODELS

MODEL	Range, R A.G.D. Dim.	A A.G.D. Dim.	B A.G.D. Dim.	C	D	E
N6I	*1.00 mm	*1⅛″	*1.322″	1⁷⁄₆₄″	.563″	No Cap
O6I	2.500 mm	1¹¹⁄₁₆″	1⅝″	1½″	⅝″	.437″
P1I	.500 mm	2¼″	2″	2¹⁄₁₆″	²³⁄₃₂″	.437″
P3I	1.250 mm					
P6I	2.500 mm					
Q1I	.600 mm	2¾″	2⅛″	2½″	⅝″	.437″
Q3I	1.250 mm					
Q6I	2.500 mm					
Q6IS	*25.000 mm					
R1I	.500 mm	3⅝″	2⁹⁄₁₆″	3⅜″	⅝″	†.031″
R6I	2.500 mm					

*Not A.G.D. dimension or range.
†No dust cap required as entire movement is enclosed in case.

The Symbol Ⓐ indicates that the dimension conforms to the American Gage Design Standard as recorded in Commercial Standard Bulletin. When designing Gages, it is recommended in the interest of accuracy that arrangements be made to support the Indicator as rigidly as possible and by the bracket on the back. Do *not* support any Indicator by the stem, as careless clamping at this point can cause binding of the spindle.



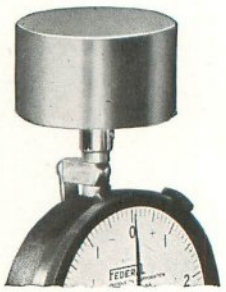
Dimensions conform with A.G.D. Commercial Standard Bulletin (Emergency) CS(E)119-45.

CONTACT PRESSURE

Some gaging conditions require a certain contact pressure. Soft material, surface requirements and other conditions may require a lighter pressure than regular. Sometimes a more positive pressure is needed. Too much pressure, however, causes strain and resultant inaccuracy. Special Indicator pull-back springs can be furnished to suit special needs. Submit your requirements.

WEIGHTS

Compressible materials such as rubber, paper, textiles, etc., should always be measured under constant contact pressure, whenever possible. In such cases, Federal provides weights on the Indicators in place of springs, to conform with technical society standards. These weights exert their pressure *directly* thru the rack spindle to contact point, not thru the movement. Submit your requirements.



CONTACT POINTS

Federal contact points are hardened steel unless otherwise ordered and are blackened to retard rusting. Several shapes and sizes are listed below. The contact end of each point is polished to prevent scratching workpiece.

REGULAR POINTS, regularly furnished with Indicators, have a 3/16" contact radius, are 3/16" in diameter and 1/4" long. Other lengths are stocked from 1/8" to 1", in 1/8" steps. Price 25 cents each. Longer lengths special.

FLAT-END REGULAR POINTS are similar to regular points but have a flat, *lapped* contact surface. Furnished in lengths from 1/4" to 1", in 1/8" steps. Price $1.00 each. Longer lengths special.

TAPER POINTS are 3/16" in diameter, tapered to a contact radius of .031". Available in four lengths, 7/16", 1", 1 7/16" and 2". Price 25 cents each.

BUTTON POINTS are 3/8" in diameter, 1/8" thick and have a contact radius of 1/4". Price 25 cents each.

WIDE FACE POINTS are used on various Federal Gages and can be used, when desired, on Federal Indicators in place of regular contact points. They are hardened and ground steel and fit the indicator spindle squarely. It is of great importance that wide face points be parallel to the opposite reference surface. Price $1.50 each.

Type B

Type D

TYPE	No.	Flat Dia. (Inches)	Max. Dia. (Inches)	Overall Length (Inches)	Body Length (Inches)	Thread Length (Inches)	Thread Size
B	AL502	.250	.365	.280	.093	.187	4–48
B	AL1510	.375	.500	.280	.093	.187	4–48
B	AL520	.500	.615	.280	.093	.187	4–48
B	AL44	.625	.750	.280	.093	.187	4–48
D	AL291	.750	.750	.437	.250	.187	4–48

SPECIAL POINTS. Other special contact points to fit individual requirements can be furnished also, if desired, prices on application.

SPECIAL HARD POINTS (Prices on request)

Where Indicator contacts are subject to excessive wear, points can be furnished tipped with diamond, tungsten carbide, boron carbide, or hard chromium plate. Care should be used in selecting the proper material. All but chromium points are gold plated for identification.

HARD CHROMIUM PLATE can be used on all types of points and is especially adapted for use on irregularly shaped points. These contacts also are suitable for use on high grade, mirror finishes as there is less tendency to mark the surface.

DIAMOND contact points are of course the hardest. They are furnished, ground and polished to a smooth surface. But there is a possibility of the edges of the diamond marking a high mirror finish if the contact has to be tipped at an angle and dragged over the surface of the workpiece. The point must have sufficient radius to provide for proper setting of the diamond.

BORON CARBIDE (Norbide, registered trademark of Norton Co.) is next in hardness to diamond. It is especially suitable for use on high mirror finishes because it has the least tendency to mark the surface. It has a tendency to crack, chip or flake when used roughly or in large flat sections. It requires sufficient radius to permit proper setting.

TUNGSTEN CARBIDE is a very hard material that far outwears steel points but is not as hard as Diamond or Boron Carbide. Tho it is very practical for average gaging, it is somewhat porous and tends to load up and scratch high finishes after long use. It can be furnished in various shapes and is readily set in permanent position.

POINTS and BACKS

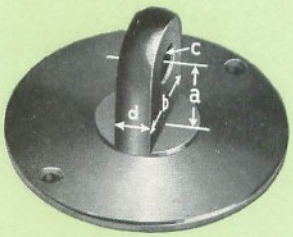
THE REGULAR BACK, shown below, is regularly furnished with all Federal Regular Type Indicators and is included in the price of the Indicator. Model A6Q has a special post back. Other backs shown can also be furnished. Special backs, designed for customers' specific requirements can also be furnished, prices on application.

REGULAR BACK with CENTRAL BRACKET

A.G.D. SPECIFICATIONS

Regularly furnished on Indicators. Bracket is centered on the back. Price separate, $1.00 ea. In stock.

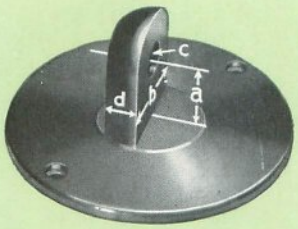
a=1/2" b=11/16"
c=1/4" d= 1/4 "



OFFSET BRACKET BACK

Bracket is offset so that one face is centered. Price separate, $1.00 ea. In stock.

a=1/2" b=11/16"
c=1/4" d= 1/4 "



POST BRACKET BACK

Price $2.00 ea. with Indicator. $3.00 separate.

a=1" b=1/2"

SCREW BRACKET BACK

Price $2.00 ea. with Indicator, $3.00 separate.

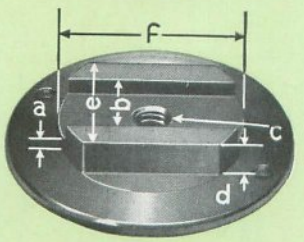
a=1/2" b=11/16" c=1/4" = 28

ADJUSTABLE BRACKET BACK

Price $2.00 ea. with Indicator. $3.00 separate.

a=1/8" b=1/2" c=1/4"=20
d=1/4" e=7/8"

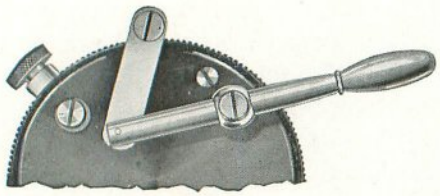
B Size f=15/16", C, D and E Sizes 1 1/4"



FLAT BACK

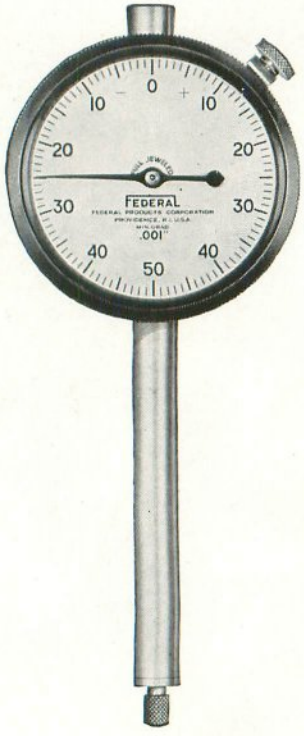
Price separate, $1.00 ea. In stock.

ATTACHMENTS



LIFTING LEVER

This retracts the Indicator contact point to permit workpiece to be placed in gaging position. It does not affect the reading or accuracy of the indicator. Fits any back shown on Page 15 except the B size adjustable bracket back. Regularly furnished on Regular Bracket type back with lever on *left* as you face the front of the Indicator, unless otherwise specified. Price $3.00 each, without back.



LONG STEM INDICATORS

These indicators extend into recesses and similar places impossible to reach with regular indicators. Federal can furnish indicators with stems of various lengths to meet specific requirements. These indicators are special and complete details are required before prices can be quoted.

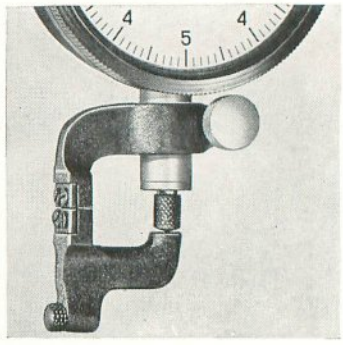
TOLERANCE HANDS

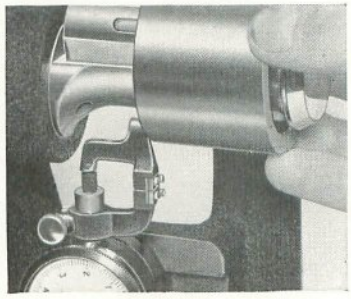
Tolerance Hands definitely mark the specified limits for any particular dimension. Federal Tolerance Hands can be furnished on any Regular Supersensitive or Perpendicular spindle indicator. They are set independent of one another by knurled knobs that extend from the crystal. Price $2.50.

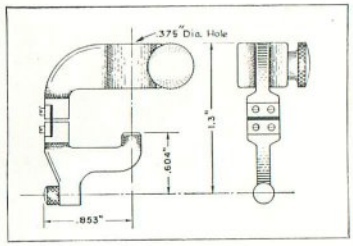
Properly used, Attachments increase the adaptability of Dial Indicators. Care should be taken that they are attached securely, located positively and are free from loose motion, bending strains, personal influence, and other negative influences.

RIGHT ANGLE OFFSET ATTACHMENT, MODEL A9-R1

This A9-R1 Attachment transfers motion at right angles to the indicator spindle, directly to the indicator. Contact arm is hinged by a flat spring eliminating inaccuracies caused by wear or play in pivot-type bearings. Contact Point is polished to prevent marring. It fits all indicators with a .375" stem. (On certain applications a longer contact point may be necessary on B, D and E indicators.) Price $3.25 each.



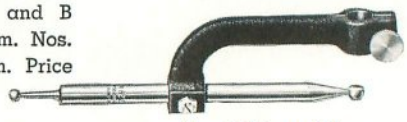




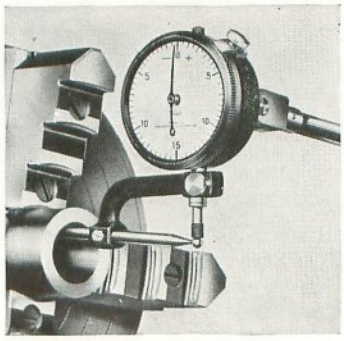
HOLE ATTACHMENTS, NO. 729

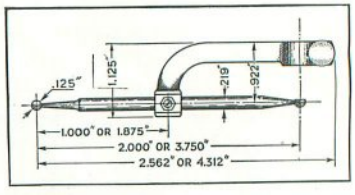
Hole attachments for testing internal and other surfaces that cannot be reached with the regular indicator spindle. They are rigid, sensitive and have an adjustable fulcrum screw. Nos. 729A and B fit Indicators with .275" stem. Nos. 729 C and D fit .375" stem. Price $1.80 each.

No. 729B and D



No. 729A and C





Note: Use longest dimensions for No. 729A and C. Use shortest dimensions for No. 729B and D.

CUSHIONED MOVEMENT INDICATORS

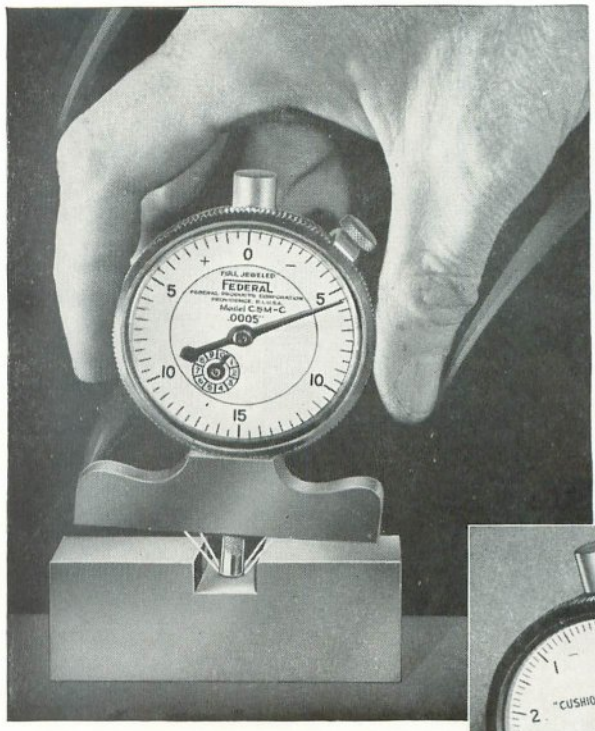
New Shock-proof Movement "Stands Up" Under Severe Use

Under certain conditions Dial Indicators have to be subjected to rough treatment, and in such cases it is necessary that the Indicator used be able to "take it" and continue to give repetitive accuracy.

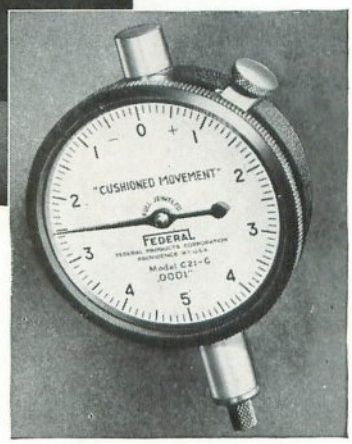
This new Indicator is provided with a cushioning device, which *absorbs* the shock or impact from the contact and *prevents* it from reaching and damaging the small gear teeth, jewels, pivots and other parts which must necessarily be small, light and sensitive if they are to be accurate. Yet there is no increase in contact pressure from compensating tension springs, and no additional friction due to sliding members.

Thorough proving of this Indicator under really severe operating conditions (even in machine coolant) has demonstrated the soundness of its design, and its stamina—in one case taking over 40,000 shocks per day with no apparent damage to integral parts or repetitive accuracy.

This new shock-proof mechanism can be furnished with, or added to, any Federal Improved-Movement Indicator of A.G.D. range (See page 5) in the Regular C, D, and E sizes (English—except E3BS) and P, Q, and R sizes (Metric—except Q6IS). The addition of this protective mechanism does not change the external appearance, nor the size of the case or stem, in any way. Price, $1.00 extra.



The inspection operation itself may be rough on an Indicator or it may be the workman.

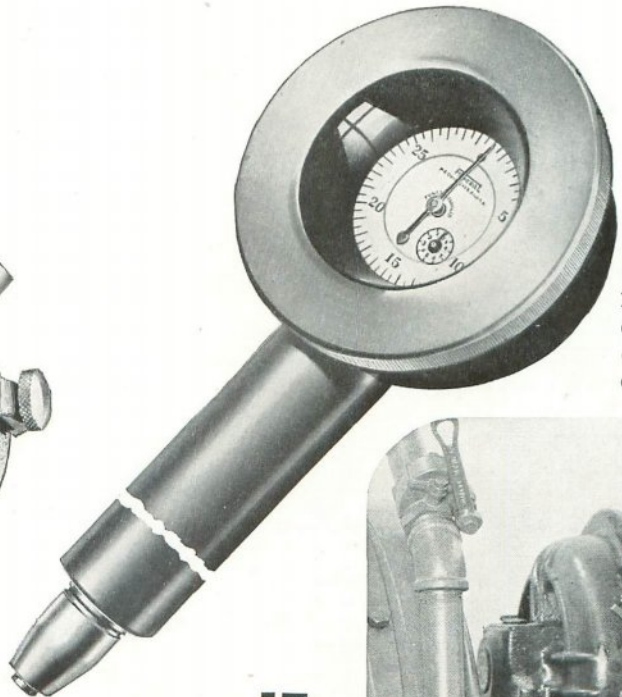


Cushioned Movement Indicators look the same, and have the same size case and stem, as Regular Types.

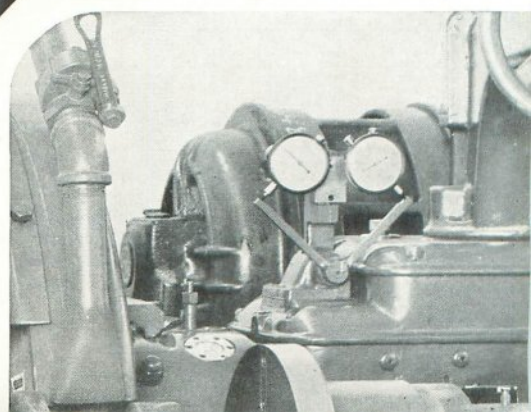
SPECIAL PURPOSE INDICATORS

Many special applications require Indicators modified to suit certain conditions. Federal engineers will work with you combining their experience in applying Indicators with your designers' needs. Two special types are illustrated.

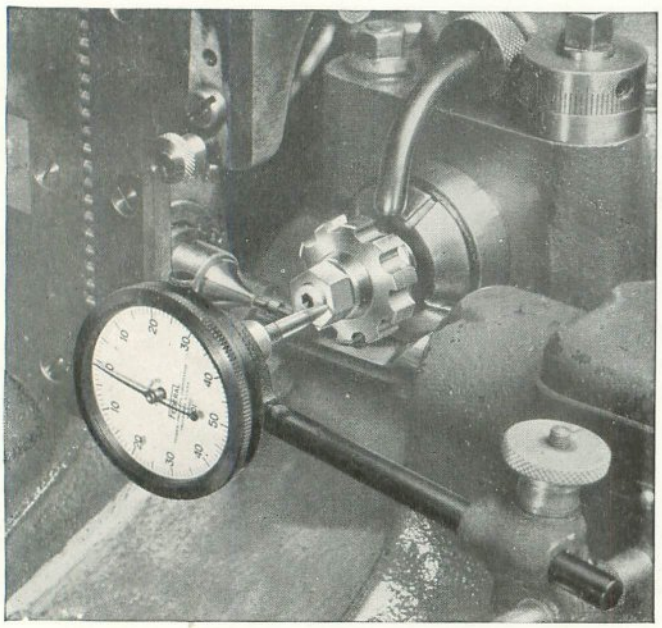
This special indicator, *the one on the left*, is equipped with a brake which holds or stops the hand at whatever point it moves to. *At right*, the Indicator is provided with a long stem for holding at various positions over a rotary grinder table and is built within a waterproof case.



Thousands of Federal Indicators are regularly furnished on machine tools and testing apparatus as standard equipment.

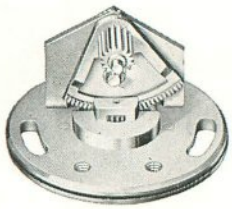


PERPENDICULAR INDICATORS



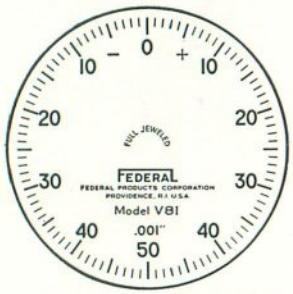
PATENTED

Illustration actual size



CROWN GEAR, as shown, provides a simple direct action, reducing friction and increasing accuracy.

ENGLISH DIAL

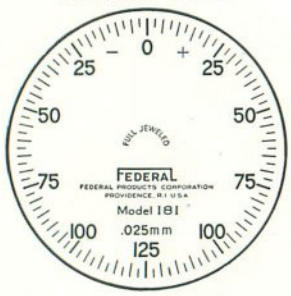


Model V8I

Graduated .001"

Range .100"

METRIC DIAL



Model I8I

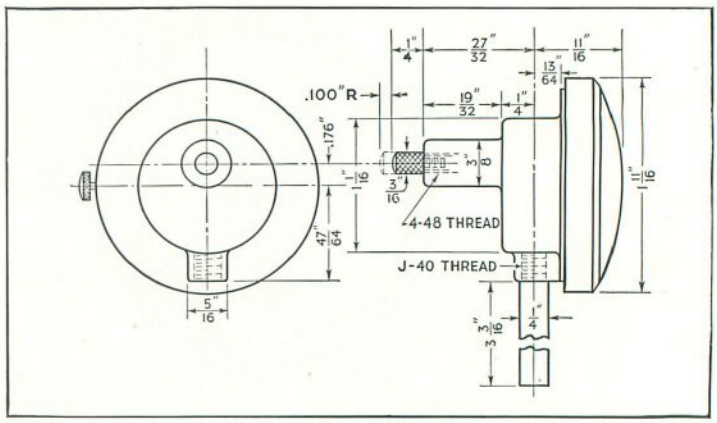
Graduated .025mm

Range 2.500mm

MODELS V AND I
CROWN GEAR TYPE

Perpendicular Spindle Indicators are specially adapted to fixtures where the movement of the contact point has to be at right angles to the dial. This Federal Indicator is the first to use a crown gear movement in place of the old spiral gear. The crown gear reduces friction to a minimum and its greater accuracy makes this perpendicular type Indicator a smooth running, sensitive and very accurate instrument. Its movement is fully jeweled, which, with the carefully polished staffs, increases its sensitivity and durability. It will give dependable repetitive readings.

DIMENSIONS



ENGLISH MODELS (Full Jeweled or Plain Bearings)

GRADUATIONS		RANGE, Inches		MODEL
Value, Inches	Number of	One Rev. of Hand	Total	1 11/16" Diam.
.001	100	.100	.100	V8I
.001	100	.100	.200	*F8I

*This model available but not stocked. Has spiral type movement instead of crown gear.

METRIC MODELS (Full Jeweled or Plain Bearings)

.025 mm	100	2.500 mm	2.500 mm	†I8I

†This model available but not stocked.

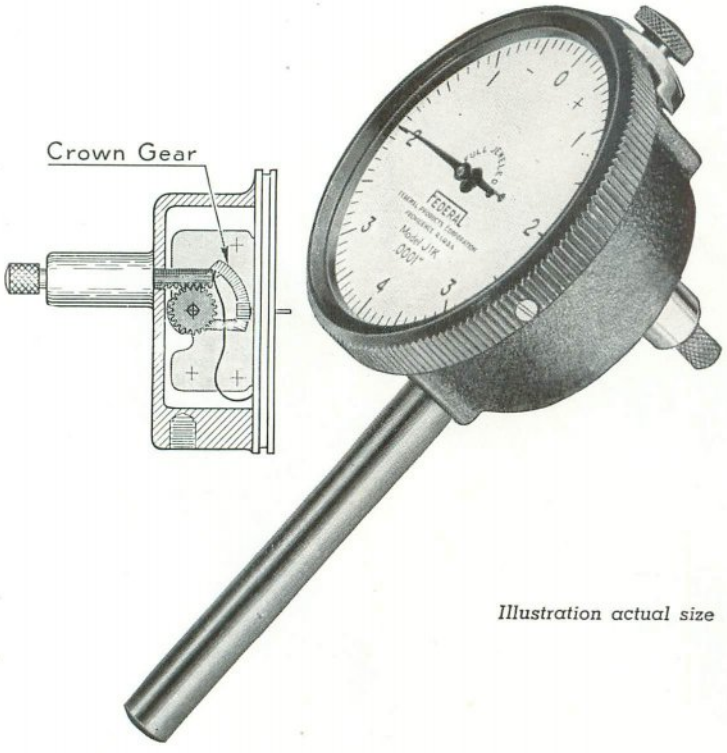
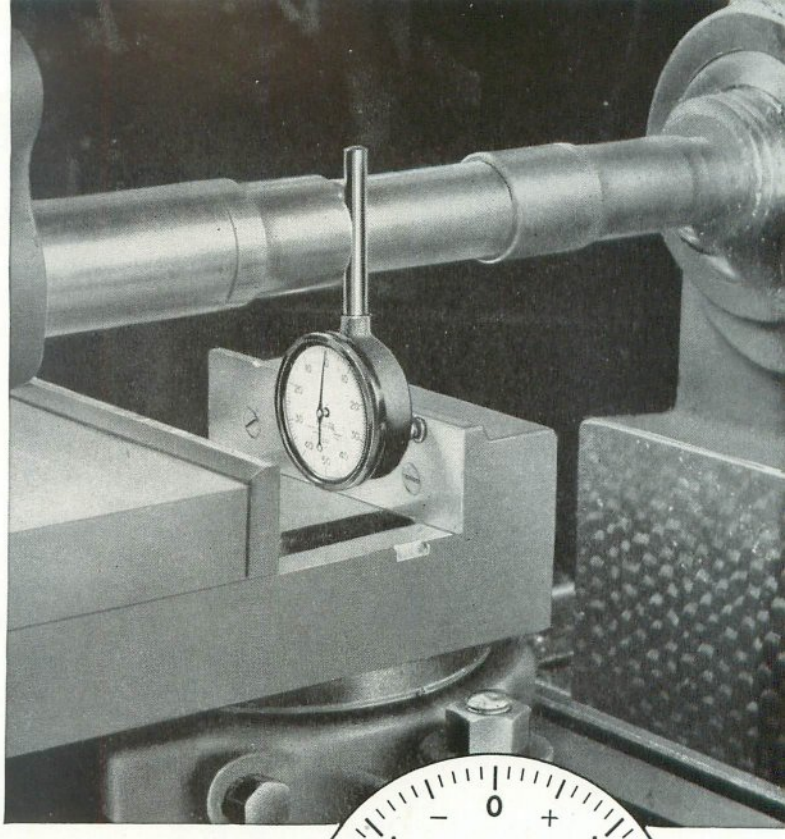


Illustration actual size



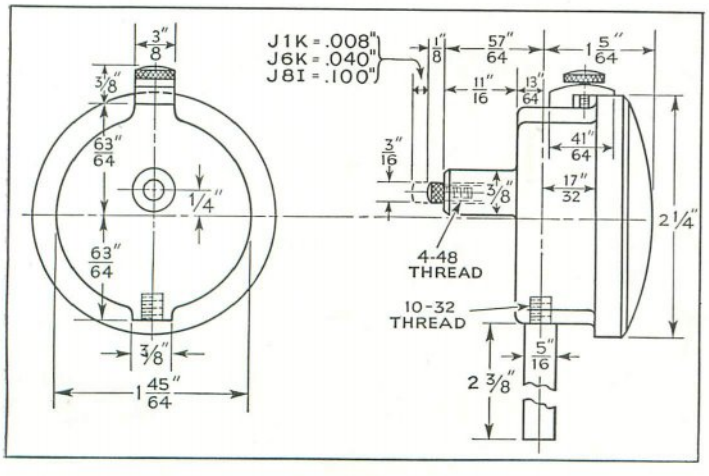
MODELS J AND W

CROWN GEAR TYPE

These newly designed Perpendicular Spindle Indicators are larger and sturdier than the V and I Models and provide for measurements in .001", .0005" and .0001" (also metric). They use the full-jeweled crown gear type of movement which has proved so successful in the V and I Models.

The Dials can be rotated for convenience in reading and setting; and the bezel is provided with a convenient clamp. Dials can be furnished either balanced as shown, or continuous.

DIMENSIONS



ENGLISH DIALS

Model J1K
Graduated .0001"
Range .008"

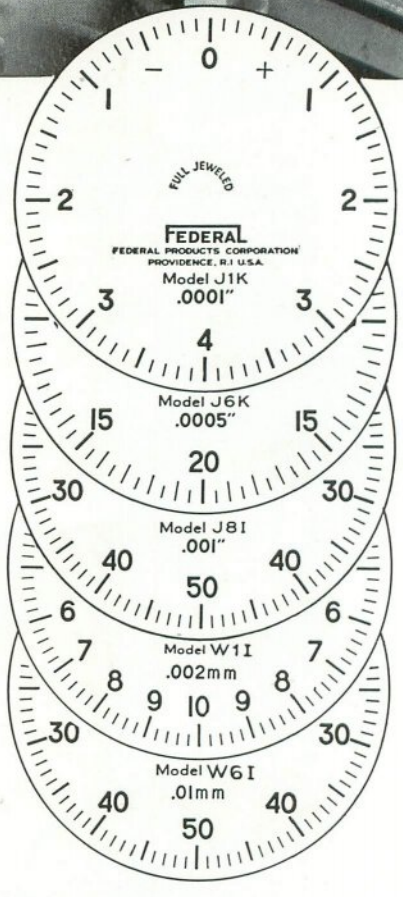
Model J6K
Graduated .0005"
Range .040"

Model J8I
Graduated .001"
Range .100"

METRIC DIALS

Model W1I
Graduated .002 mm
Range .2 mm

Model W6I
Graduated .01 mm
Range 1.0 mm



ENGLISH MODELS (Full Jeweled Only)

GRADUATIONS		RANGE, Inches		MODEL
Value, Inches	Number of	One Rev. of Hand	Total	Size 2¼" Diam.
.0001	80	.008	.008	J1K
.0005	80	.040	.040	J6K
.001	100	.100	.100	J8I

METRIC MODELS (Full Jeweled Only)

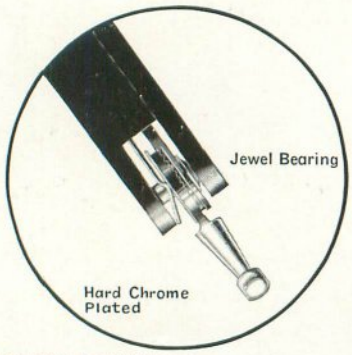
.002 mm	100	.2 mm	.2 mm	W1I
.01 mm	100	1.0 mm	1.0 mm	W6I

FEDERAL TESTMASTER

TRADEMARK REG. U. S. PAT. OFF.

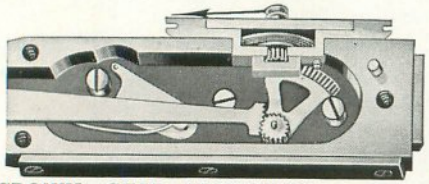
TWO TYPES

Regular and Perpendicular Dials

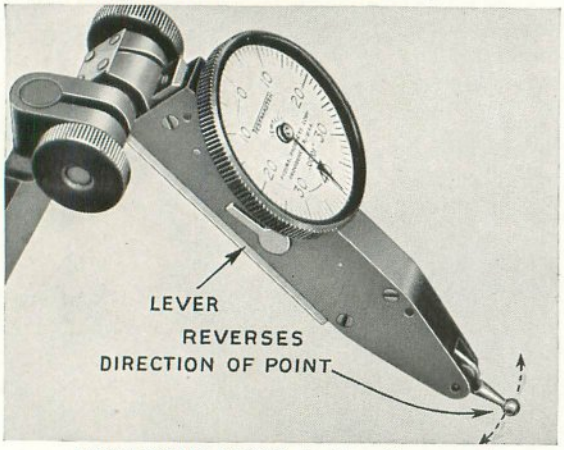


POINT .100″ Diam.
SPECIAL POINT .031″ Diam. Extra

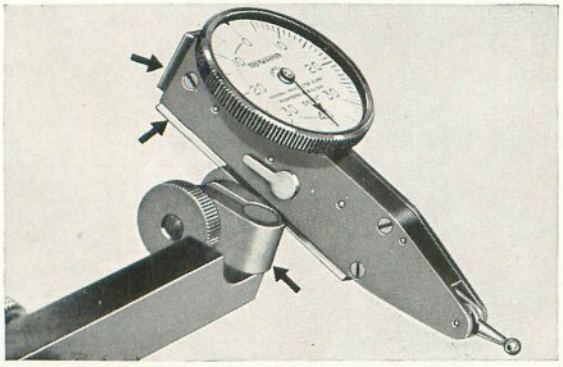
INDEX POINT locks in place, but can be taken out for replacement. Can be set at any angle within 180° arc. Hard chrome plated for long wear.



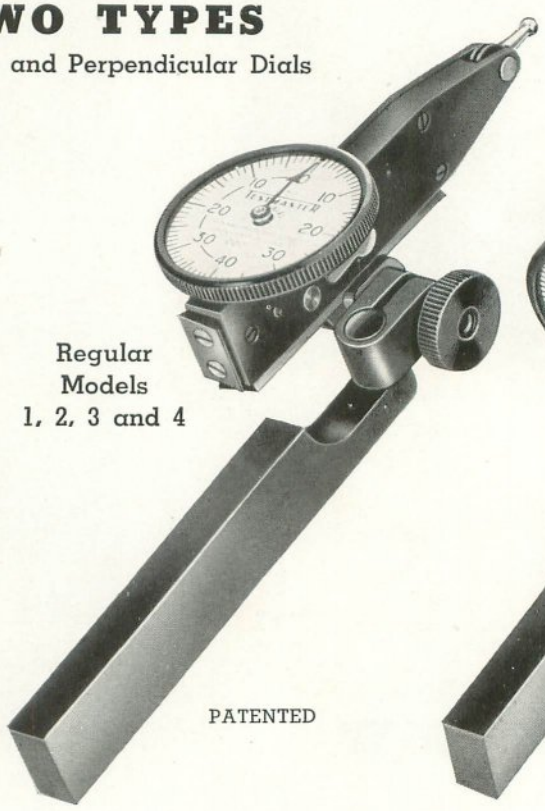
CROWN GEAR MOVEMENT reduces friction and inertia. Gear teeth are specially hobbed for maximum accuracy.



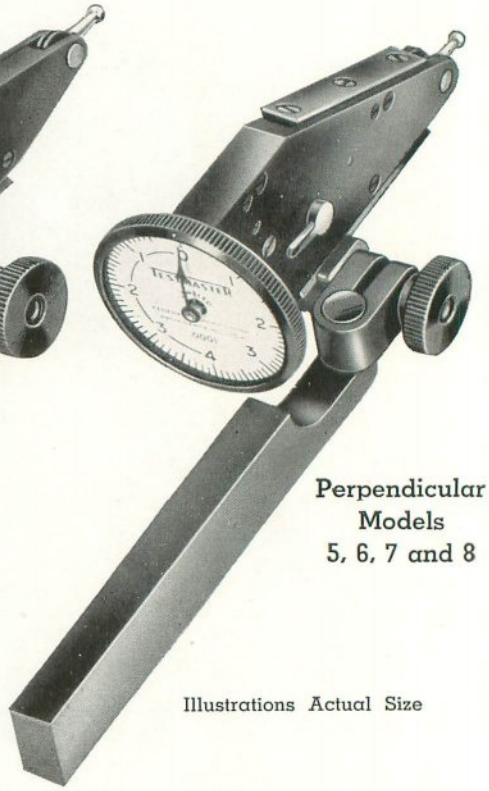
REVERSIBLE POINT doubles the use of the instrument. Point is hard chrome plated.



DOVETAIL SLIDES and **UNIVERSAL CLAMP** make the Testmaster the easiest to set and insure rigid support. Rigidity is of great importance for accuracy. Dial rotates for setting zero.



Regular Models 1, 2, 3 and 4



Perpendicular Models 5, 6, 7 and 8

PATENTED

Illustrations Actual Size

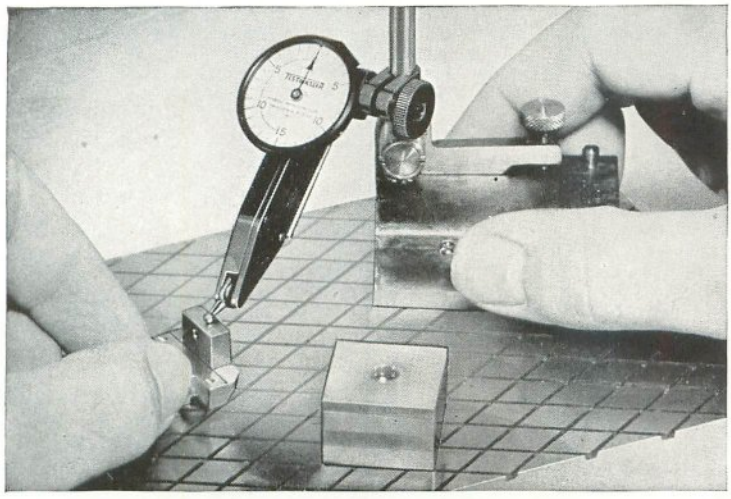
UNIVERSAL TEST INDICATORS

Adaptability without sacrifice of accuracy is the outstanding requirement of a universal type of Test Indicator. This accounts for the immediate acceptance and popularity of the Federal Testmaster, with the new Index Point. Adaptability is obtained, very simply, without the use of complicated adapters, which are not only cumbersome but also cause inaccuracies due to friction, lost motion and deflection. The Testmaster is a very high grade instrument of unusual sensitivity and repetitive accuracy.

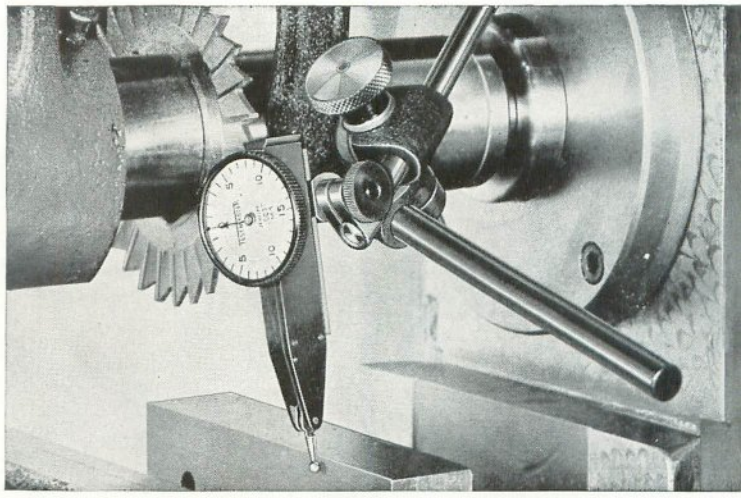
SIMPLE MOVEMENT: The movement is a simple, direct combination of lever and crown gear. A hairspring takes up any gear backlash. All bearings are jewelled.

RUGGED CONSTRUCTION: The Testmaster is ruggedly built. Many are in use on production inspection, as well as on the multitude of tests in machine shop and tool room operations, where its adaptability is so much appreciated.

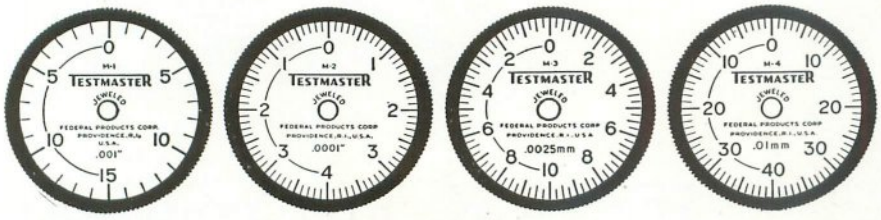
COMPACT AND HIGHLY ADAPTABLE: The Testmaster is no larger than your thumb and is adaptable to all tool posts, height and surface gages.



Testmaster held in surface gage checks dimension of workpiece by comparing it with gage blocks. Point can be set at any convenient angle within 180°.



Testmaster attached to milling arbor used to line up parallelism of vise jaws with table travel. One of hundreds of applications.



Models 1 & 5 English | Models 2 & 6 English | Models 3 & 7 Metric | Models 4 & 8 Metric

SPECIFICATIONS

	Graduated	Range	Dial
Models 1 & 5 (English)	.001"	.030"	0-15-0
Models 2 & 6 (English)	.0001"	.008"	0- 4-0
Models 3 & 7 (Metric)	.0025 mm	.2 mm	0-10-0
Models 4 & 8 (Metric)	.01 mm	.8 mm	0-40-0

Ball Contact Point .100" Dia. regular — special .031" Dia. Ball Point also available for Models 1, 2, 3, 5, 6 and 7 at $1.50 each.

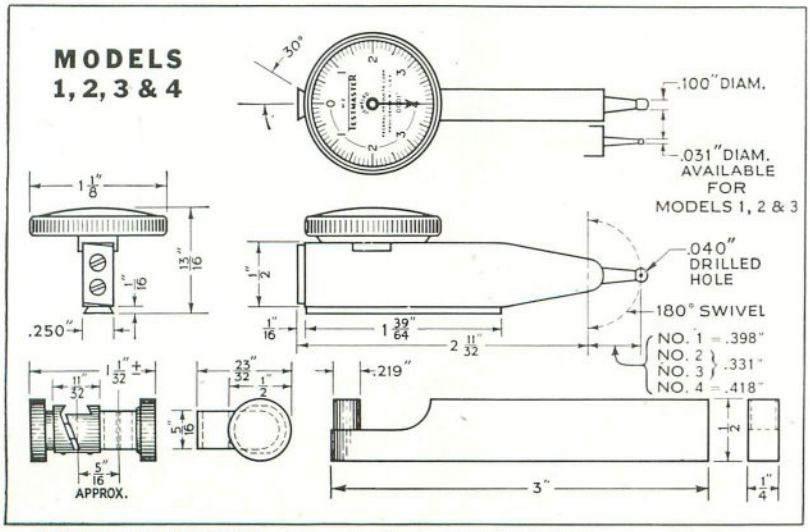
Weight of Indicator only . . . . . 1½ oz.

Each Testmaster is furnished in a handsome plastic case complete with Holding Bar (¼" x ½" x 3" long) and Universal Clamp.

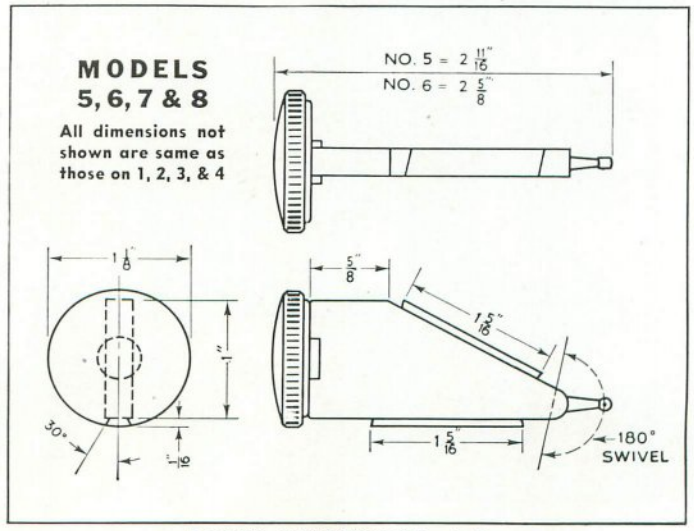
Special Jig Borer Holding Rod, RD-21, for use in Drill Chucks etc. — $2.50 extra. (See illustration at right.)

Various other Holding Bars can be furnished for adapting Indicators to surface and height gages or test sets, which regular clamp and bar will not fit. Tell us on what instruments you intend to use the Indicator.

Perpendicular type Testmaster facilitates reading on jig borers and similar applications.

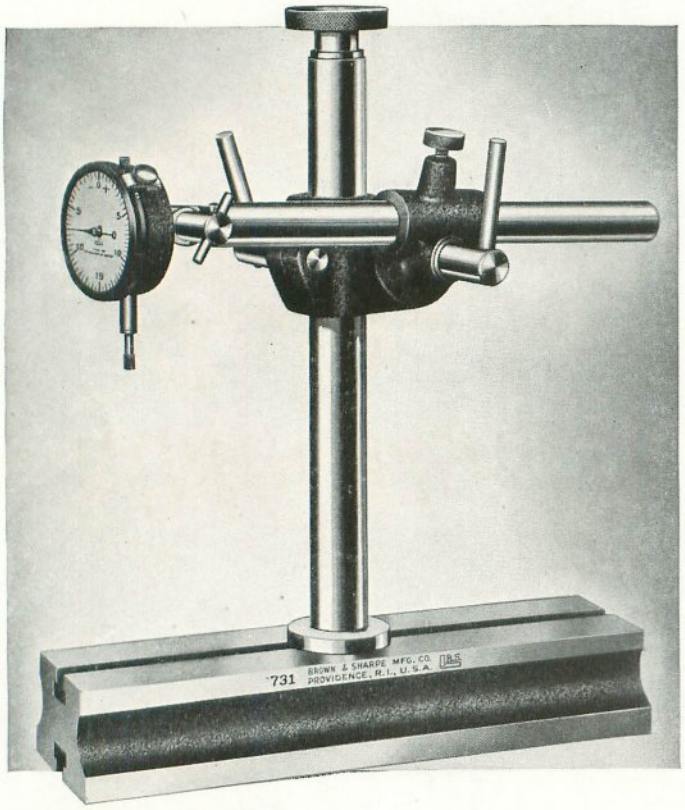


DETAIL DIMENSIONS of Regular Type TESTMASTERS and regularly furnished clamp and bar.



DETAIL DIMENSIONS of Perpendicular Type TESTMASTERS.

TEST SETS

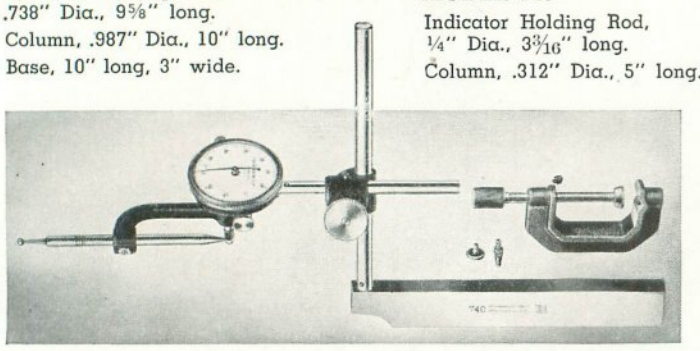


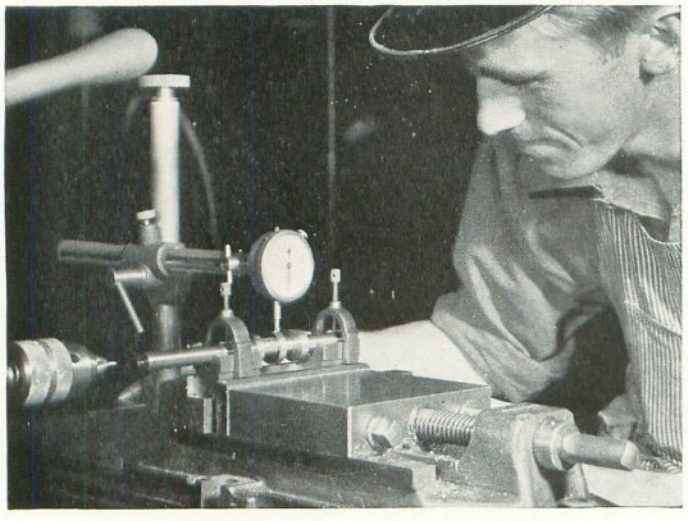
MODELS 731 AND 731A

Indicator Holding Rod, .738" Dia., 9⅝" long.
Column, .987" Dia., 10" long.
Base, 10" long, 3" wide.

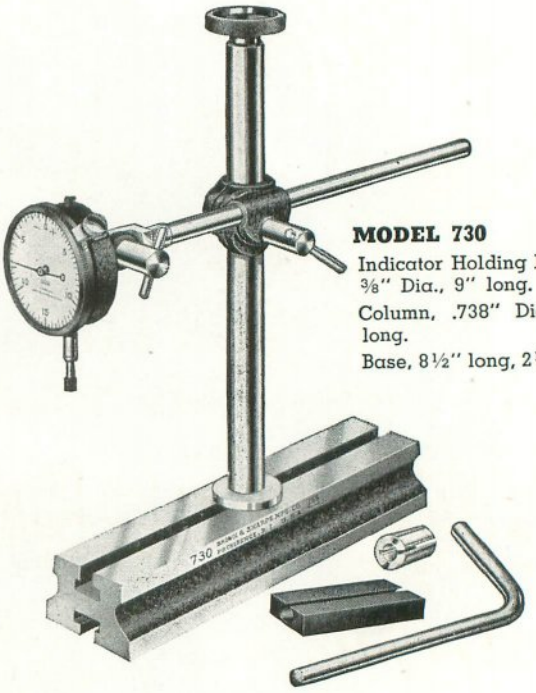
MODEL 740

Indicator Holding Rod, ¼" Dia., 3 3/16" long.
Column, .312" Dia., 5" long.





DIAL TEST SETS are especially serviceable to set-up men for determining the accuracy of their work.



MODEL 730

Indicator Holding Rod, ⅜" Dia., 9" long.
Column, .738" Dia., 8¾" long.
Base, 8½" long, 2¼" wide.

FEDERAL DIAL INDICATORS

Combined with Brown and Sharpe Test Sets

These Dial Indicator Test Sets are a great convenience in any tool room, machine shop, garage and repair shop. They are easily applied to various types of layout work, lineup jobs and general checking. Dimensions are easily controlled on production because they are so adaptable to various types of machine tools.

Setup men, erectors and inspectors use them for determining the accuracy of surfaces, spindles, arbors, etc. Machinists need them for layout work, for checking runout and for general checking during production. Toolmakers require them for obtaining comparative measurements on close work. Garage and repair shop men will find them a great help for lineup jobs on automotive engines and parts assemblies.

Test Sets are well-proportioned, rigid and easily adjusted. The holding rod is attached to the upright by a sliding swivel which permits positioning of the Indicator at any angle. Lever clamps provide quick, positive adjustments.

When it is anticipated that usage will be unusually severe, we suggest that you consider the Cushioned Movement Indicators.

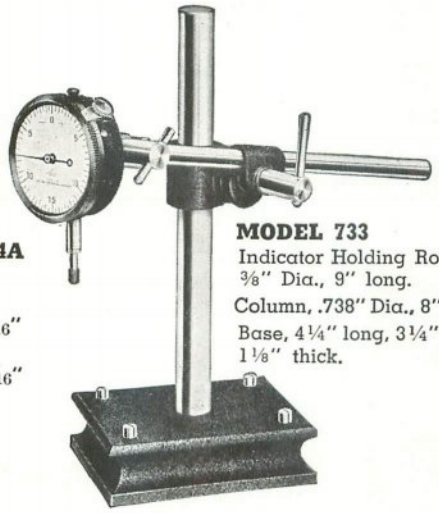
SPECIFICATIONS

MODEL 730 TEST SET

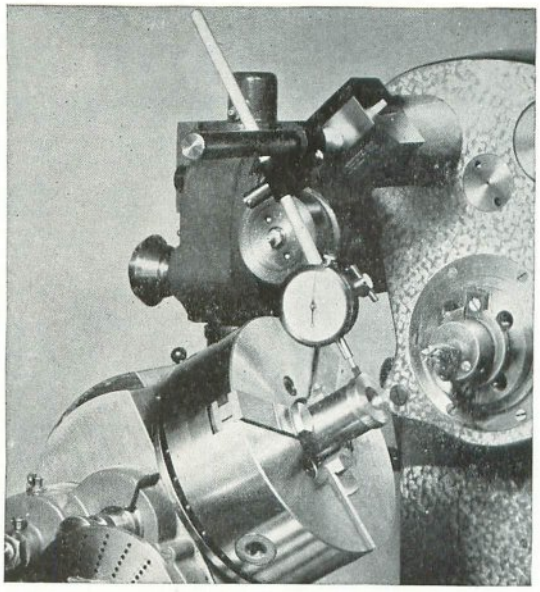
Upright is large diameter and tubular. It is very rigid. Knurled nut at top of upright conveniently clamps it to base. Includes Tool Post Clamp, Slide Support Rod and Adapter Bushing.

ENGLISH		METRIC	
Indicator, Model	C5M	Indicator, Model	P6I
Minimum Graduation	.0005"	Minimum Graduation	.010 mm.
Range	.075"	Range	2.50 mm.

MODELS 744 AND 744A
Indicator Holding Rod, 3/8" Dia., 9" long.
Column, .738" Dia., 7 13/16" long.
Base, 2 3/4" long, 2 7/16" wide, 2 7/16" thick.



MODEL 733
Indicator Holding Rod, 3/8" Dia., 9" long.
Column, .738" Dia., 8" long.
Base, 4 1/4" long, 3 1/4" wide, 1 1/8" thick.



DIAL TEST INDICATOR with magnetic base can be readily attached to any magnetically conductive surface and used in many places that ordinarily require special fixtures.

SPECIFICATIONS *(Continued)*

MODEL 731 TEST SET

A Super-Rigid Test Set. Each movement has separate clamp so that individual adjustments can be made without disturbing other settings.

ENGLISH		METRIC	
Indicator, Model	C5M	Indicator, Model	P6I
Minimum Graduation .	.0005"	Minimum Graduation	.010 mm.
Range	.075"	Range	2.50 mm.

MODEL 731A TEST SET

Similar to Model 731 but furnished with following Indicators.

ENGLISH		METRIC	
Indicator, Model	C2I	Indicator, Model	P1I
Minimum Graduation .	.0001"	Minimum Graduation	.002 mm.
Range	.025"	Range	.50 mm.

MODEL 733 TEST SET

Base is handy design and heavy to provide firm support. Four gage pins in corners are for use against edge of surface plate, T slot, etc.

ENGLISH		METRIC	
Indicator, Model	C5M	Indicator, Model	P6I
Minimum Graduation .	.0005"	Minimum Graduation	.010 mm.
Range	.075"	Range	2.50 mm.

MODEL 740 TEST SET

This Tool Post Type Test Set makes possible testing to a depth of 1 11/16", internal dimensions that cannot be reached with regular Indicators. Point is 7/32" diameter. For Indicator Attachment (729) see pg. 20.

ENGLISH		METRIC	
Indicator, Model	V8I	Indicator, Model	I8I
Minimum Graduation .	.001"	Minimum Graduation	.025 mm.
Range	.100"	Range	2.50 mm.

MODEL 744 TEST SET (with Magnetic Base)

(Models 744 and 744A on sale only in U.S.A. and its Territories)

A permanent magnet allows base to be held in upside down and other positions impossible with other Test Sets. Solid upright makes this set exceptionally rigid.

ENGLISH		METRIC	
Indicator, Model	C5M	Indicator, Model	P6I
Minimum Graduation .	.0005"	Minimum Graduation	.010 mm.
Range	.075"	Range	2.50 mm.

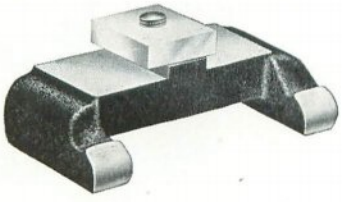
MODEL 744A TEST SET (with Magnetic Base)

Similar to Model 744 but furnished with following Indicators.

ENGLISH		METRIC	
Indicator, Model	C2I	Indicator, Model	P1I
Minimum Graduation .	.0001"	Minimum Graduation	.002 mm.
Range	.025"	Range	.50 mm.

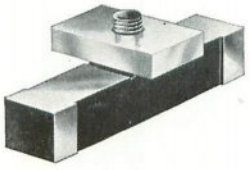
STOPS

For use on Test Sets Nos. 730, 731 and 731A



ANGULAR BASE STOP

Fastens to Indicator Base and is used against edge of dovetail, angular slot, etc.



PLAIN BASE STOP

Fastens to Indicator Base and is used against edge of surface plate, T Slot, etc.

In ordering Stops, specify whether for use on No. 730 or 731 and 731A Indicators.

CLAMP ATTACHMENT NO. 734A

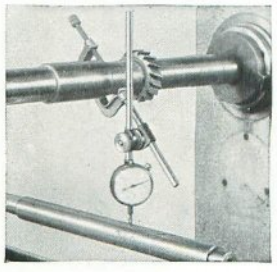
ADAPTER BUSHING

For use with Test Sets, Price, $3.00.
Capacity 9/16" to 2 3/4" Diam.
Rod .375" Diam., 5 9/16" Long.

For use in holding dial indicator swivel and arm to arbor, spindle or similar machine member while checking runout of parts or alignment of fixtures. Brass shoe on end of bolt swivels to prevent injury to a finished surface.

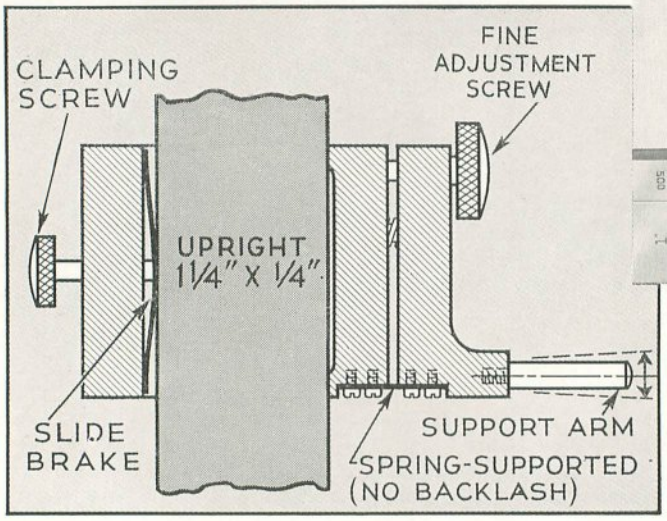
As rod is .375" in diameter, attachment can be used only with Indicators having swivels for upright and dial holding rods .375" in diameter. Attachment can be used also with Test Sets Nos. 730, 733, 744 and 744A having uprights .738" diameter, by means of an Adapter Bushing. Adapter Bushing Price, 60 cents extra.

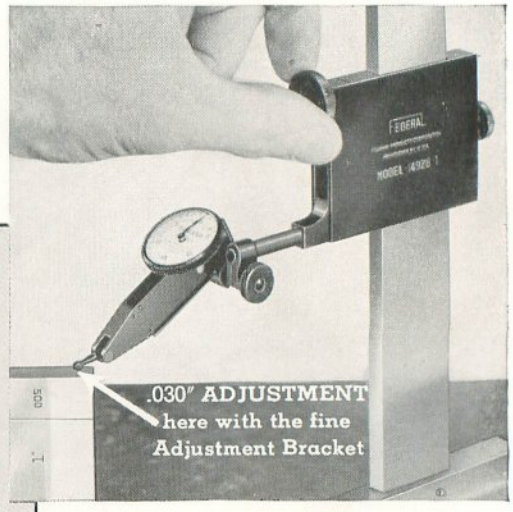
Attachment holds Indicator firmly from machine arbor.



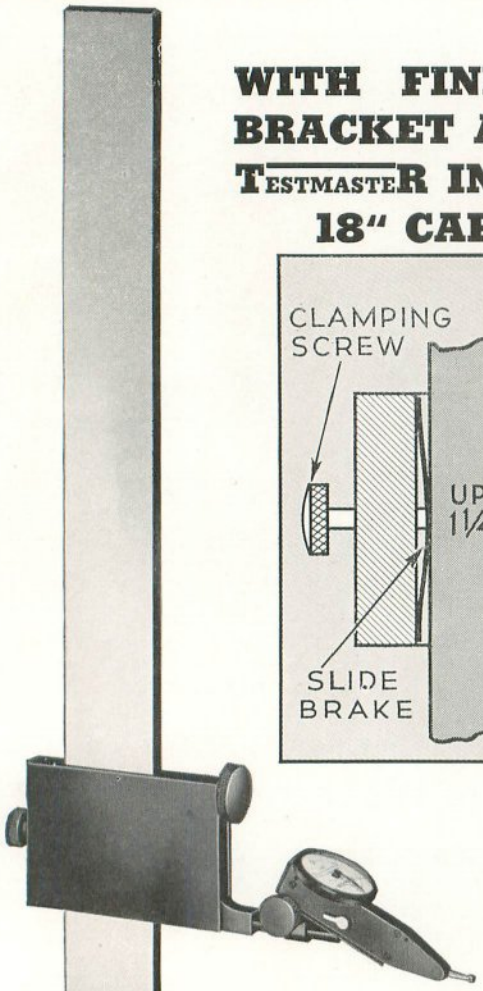
MODEL 1492 HEIGHT GAGE

WITH FINE ADJUSTMENT BRACKET AND A FEDERAL TESTMASTER INDICATOR. 18" CAPACITY

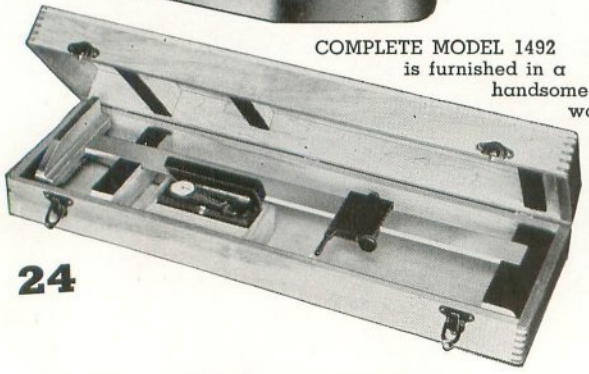




You can set the Testmaster Indicator at any angle — down in a hole, sidewise, or close up to the bracket.



The Fine Adjustment Bracket will not drop on the upright when unclamped. There is no lost motion or backlash in the Fine Adjustment. You can buy the Fine Adjustment Bracket only, if desired. It will fit any Height Gage having an upright 1¼" x ¼".



COMPLETE MODEL 1492 is furnished in a handsome wooden case

No more "tapping" is necessary when you set the Indicator to gage blocks, master or work. The **fine adjustment** brings the Indicator into position positively and yet as lightly as a feather. The Bracket can be set anywhere on the upright. You will find it is more convenient, more precise and requires no figuring. Just "set" and check.

Either the Model 1 Testmaster (Graduated .001", range .030") or the Model 2 Testmaster (Graduated .0001"; range .008") can be furnished (Metric Indicators also available). Full description of these Test Indicators is given on pages 20 and 21.

The adjusting screw of the Fine Adjustment Bracket raises and lowers the Contact Point of the Indicator a distance equal to the full range of the Model 1 Testmaster, or .030"; and the Dovetail Slides and the Universal Clamp enable setting the Indicator in practically any position.

SPECIFICATIONS

Model 1 Federal Testmaster, Graduated	.001"
Dial	0–15–0
(Metric available, Model 4	.01 MM)
Range	.030"
Model 2 Federal Testmaster, Graduated	.0001"
Dial	0–4–0
(Metric available, Model 3	.0025 MM)
Range	.008"
Contact Point	.100" Diam.
(.031" Diam. available at $1.50 each)	
Fine Adjustment Range	.030"
Maximum Vertical Capacity	18"
Upright	1¼" x ¼" x 20"
Mounting Stud	.219" Diam.
Maximum Distance, Contact Point to Upright	4½"
Base, ground and lapped	5⅜" x 2¼" x ⅞" high
Weight, complete with Testmaster Indicator	3½ lbs.

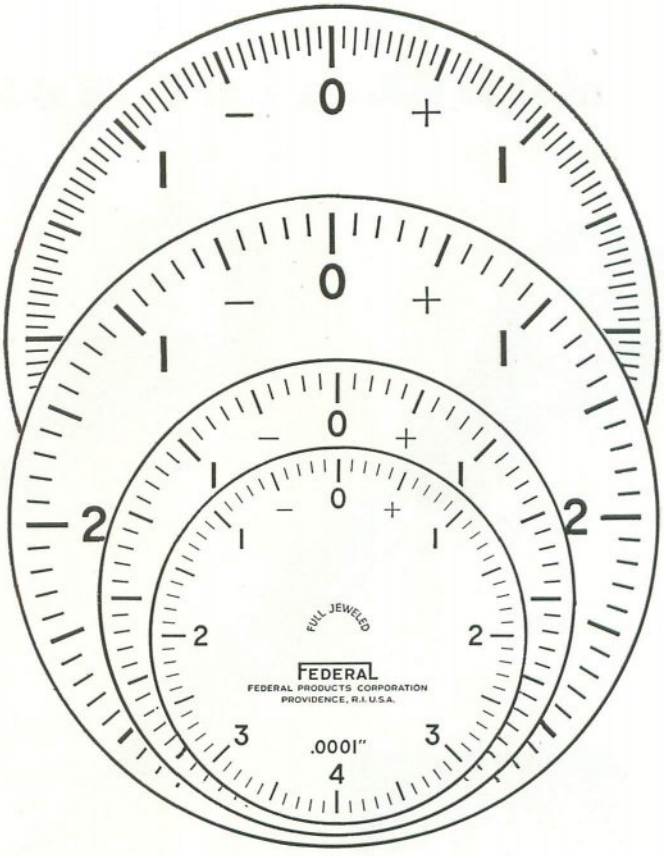
Furnished in wooden case.

SUPER-SENSITIVE INDICATOR
REGULAR TYPE

Illustration actual size

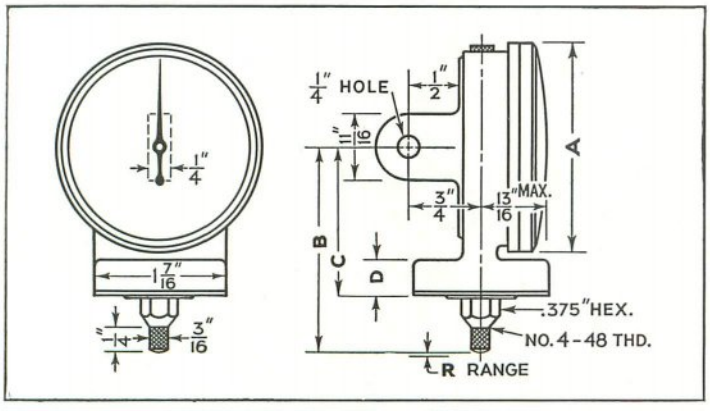
THE LOWER END of the contact spindle is bellows supported and the movement sealed off from all dust.

PATENTED



The movement is entirely enclosed. All jewels are the highest grade, carefully polished sapphire. Contact travel is limited to a short range for greater accuracy, yet it is sufficient for the precise measurements required of the Indicators. Dust *cannot* enter even through the contact spindle. These Indicators are durable and suitable for production and tool room inspection as well as laboratory.

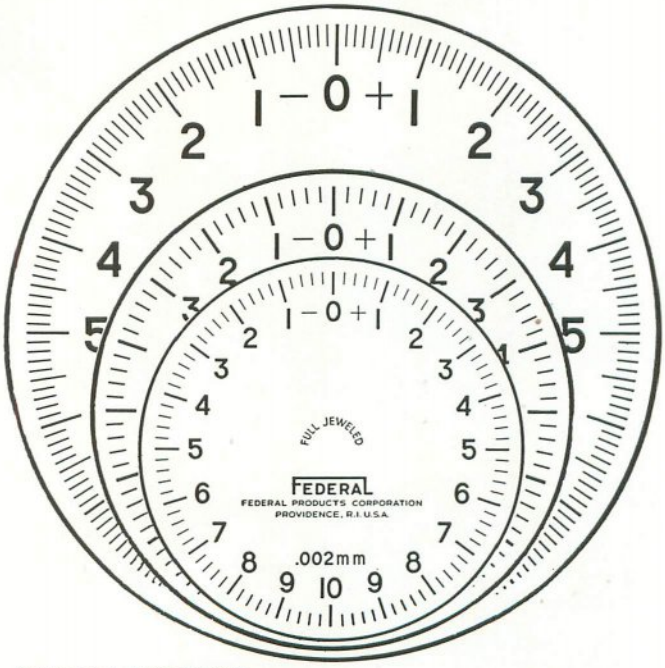
DIMENSIONS REGULAR TYPE



ENGLISH		METRIC		A	B	C	D
Model	R Range, in.	Model	R Range, mm.	Inches	Inches	Inches	Inches
C1KB	.008	P1IB	.200	2 1/4	2 11/32	1 5/8	7/16
D1KB	.008	Q1IB	.200	2 3/4	2 25/32	2	5/8
E1KB	.008	--	--	3 5/8	3 7/32	2 7/16	37/64
E1DB	.008	R1BB	.200				

ENGLISH MODELS

GRADUATIONS		RANGE, inches Total	C 2 1/4" Diam.	D 2 3/4" Diam.	E 3 5/8" Diam.
Value inches	Number of				
.00005	160	.008	--	--	E1DB
.0001	80	.008	C1KB	D1KB	E1KB



METRIC MODELS

GRADUATIONS		RANGE, mm. Total	P 2 1/4" Diam.	Q 2 3/4" Diam.	R 3 5/8" Diam.
Value mm.	Number of				
.001	200	.200	--	--	R1BB
.002	100	.200	P1IB	Q1IB	--

All Metric Indicators are available but not stocked.

MODEL 1201 SERIES

PATENTED

REGULAR DIAL. Permits full range of gage. Furnished on all models unless otherwise specified.

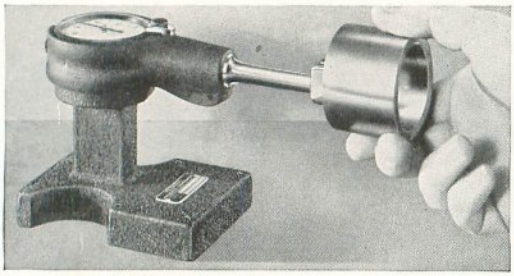
DIAMETERS FROM .500″ to 12.665″
LENGTHS IN 3″, 6″ and 12″

(*Other diameters and lengths available*)

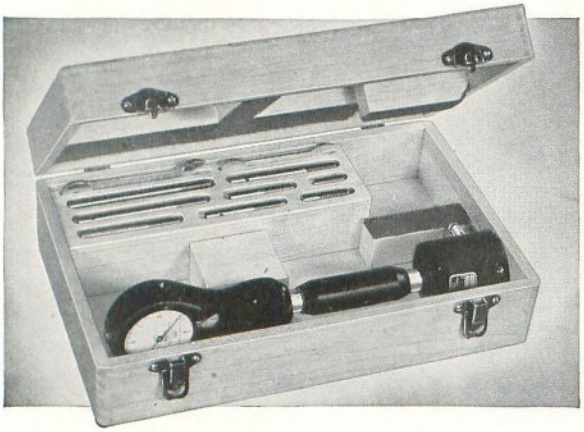
Though the gaging heads differ in the different diameter sizes the frictionless, no lost-motion, no-wear, sensitive contact unit is of the same construction. See previous page. The fixed contact extensions are adjustable for all diameters within the gaging capacity of each model.

Two regular measuring lengths are available for the gages except Model 1201P-0, but longer or shorter lengths and smaller and larger diameter gages can be furnished at special prices. Variations in gaging head designs can be furnished to meet special requirements.

Though these gages are exceptionally accurate and sensitive to very fine dimensional variation, they are also very sturdy. As they are entirely mechanical they show dimensional variations instantly. They are not dependent upon air or electrical connections, nor the various attachments required with such instruments. See opposite page for specifications.



1201 GAGES can also be used on the bench, with the use of this stand.



1201 SERIES HOLE GAGES are furnished in substantial case.

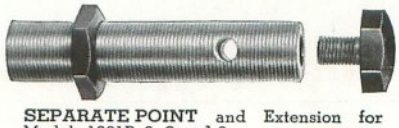
EXTENSIONS

Each gage is regularly furnished with one extension.

On Models 1201P-0 and 1201P-1 and on Blind Hole Models 1201P-20 and 21 the reference point is integral with each extension.

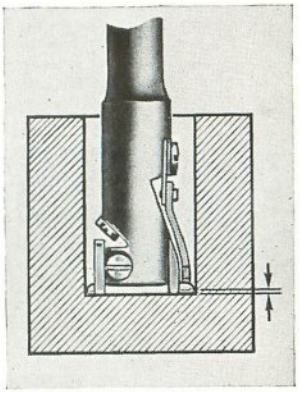
INTEGRAL EXTENSION POINT for Models 1201P–0 and 1201P–1.

On all other models listed, the diamond reference point is not integral with the extension. The point can be interchanged with extensions of other lengths.



SEPARATE POINT and Extension for Models 1201P–2, 3 and 6.

FOR BOTTOM OF BLIND HOLES

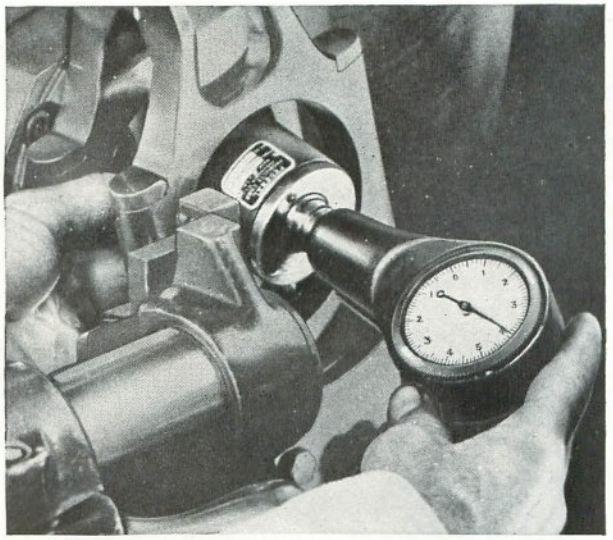


PATENTED

1201P-20 SERIES GAGES

check within .030" of the bottom of blind holes. The design of these gages is the same as the regular 1201P gages except for modifications in the gaging contacts. Specifications are as listed below, except that Sensitive and Reference Contacts are chrome plated steel.

.030" to bottom of hole



YOU CAN SEE the dimensional variation much easier and faster with a 1201P gage than with conventional gages.

SPECIFICATIONS

Indicator Model C1K
Metric Indicator, Model P1I
Minimum Graduation . . . . .0001"
Dial, Balanced (Can be rotated) 0-4-0
Contacts, Sensitive and Reference . . . . . Polished Diamond
(Boron Carbide Contacts furnished upon request)
Contacts, Locating . . . . . Hardened & Polished Steel
Range of Sensitive Contact . . . . . —.005", +.003"

RANGES AND LENGTHS

Model 1201 Gages are available in sizes and gaging lengths as listed below. Gages other than these are special at extra prices. All models are regularly furnished with *one extension only* to cover a certain range. See table below. Additional extensions are extra. For details of extensions, see bottom of opposite page.

REGULAR MODELS (Portable and Bench)

MODEL	Total Range with All Extensions*	Ranges Covered by Each Extension*	Gaging Lengths	Distance From Contact to End
Portable 1201P-0 Bench 1201B-30	.500" to .750" Requires 3 Extensions	.500 to .585" .585 to .670" .670 to .750"	3"	.165"
Portable 1201P-1 Bench 1201B-31	.750" to 1.250" Requires 4 Extensions	.750 to .875" .875 to 1.000" 1.000 to 1.125" 1.125 to 1.250"	3" and 6"	.327"
Portable 1201P-2 (Bench-special)	1.250" to 2.250" Requires 3 Extensions	1.250 to 1.583" 1.583 to 1.916" 1.916 to 2.250"	3" and 6"	.500"
Portable 1201P-3 (Bench-special)	2.250" to 4.125" Requires 4 Extensions	2.250 to 2.719" 2.719 to 3.187" 3.187 to 3.656" 3.656 to 4.125"	6" and 12"	.312"
Portable 1201P-4 (Bench-special)	4.000" to 10.000" Requires 5 Extensions	4.000 to 5.333" 5.333 to 6.666" 6.666 to 8.000" 8.000 to 9.333" 9.333 to 10.000"	6" and 12"	.438"
Portable 1201P-6 (Bench-special)	6.000" to 12.665" Requires 2 Extensions	6.000 to 9.330" 9.330 to 12.665"	6" and 12"	.438"

BLIND HOLE MODELS (Portable and Bench)

Portable 1201P-20 Bench 1201B-40	.500" to .750" Requires 5 Extensions	.500 to .550" .550 to .600" .600 to .650" .650 to .700" .700 to .750"	3"	.030"
Portable 1201P-21 Bench 1201B-41	.750" to 1.250" Requires 8 Extensions	.750 to .812" .812 to .875" .875 to .937" .937 to 1.000" 1.000 to 1.062" 1.062 to 1.125" 1.125 to 1.187" 1.187 to 1.250"	3" and 6"	.030"

*Only one extension included in price of gage. Additional extensions are extra.
Larger sizes and models with longer or shorter gaging lengths are special. Prices on request.
Portable Models are furnished in a wooden case. Cases for Bench Models can be supplied at slight extra cost.

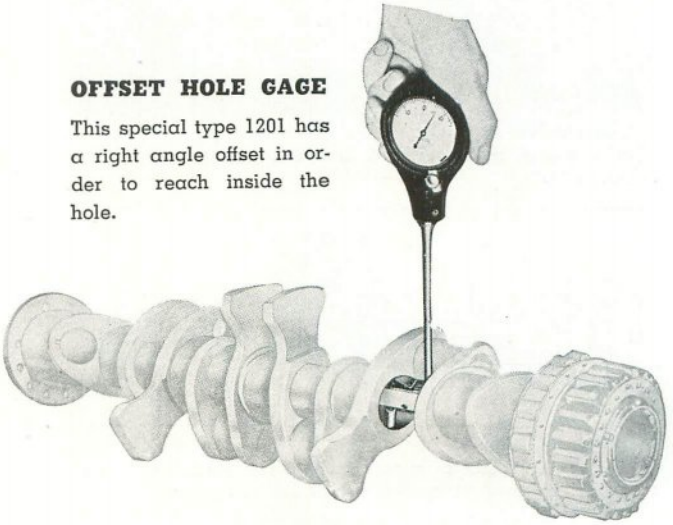
SHALLOW HOLE GAGE

This gage is equipped with a three point spider locator. This adapts the gage so that it is easy to check very shallow pieces where the gage cannot be successfully rocked. It also locates the gage at right angles to the *axis* of the hole as well as establishes the measuring depth.

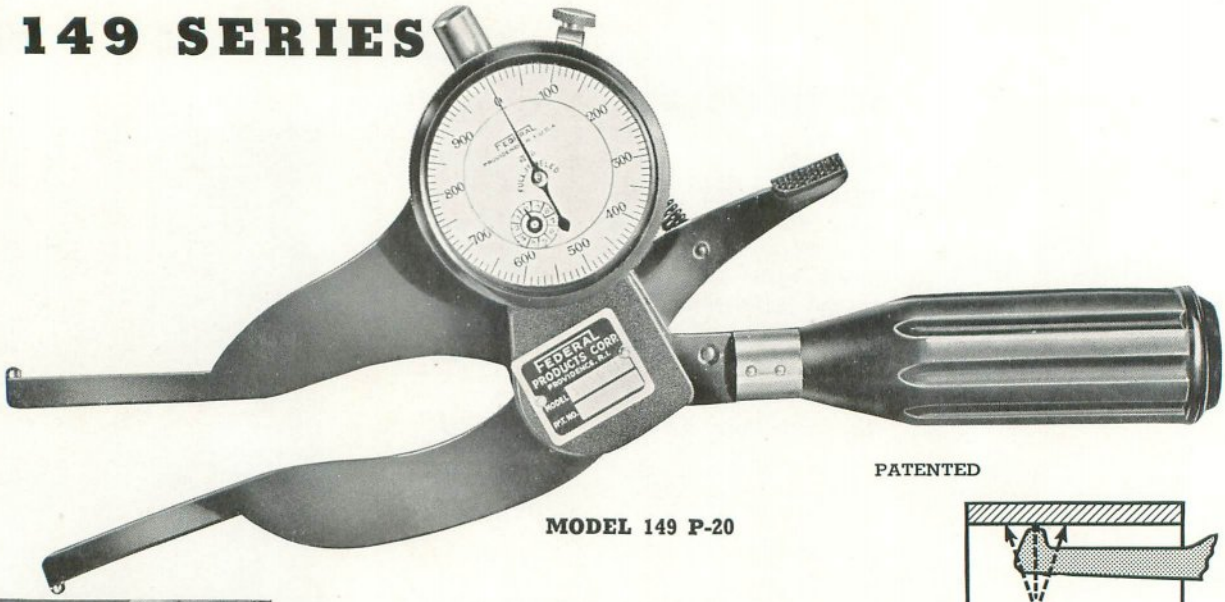
When special modifications are desired, please supply complete information including blueprints of the part to be checked.

OFFSET HOLE GAGE

This special type 1201 has a right angle offset in order to reach inside the hole.

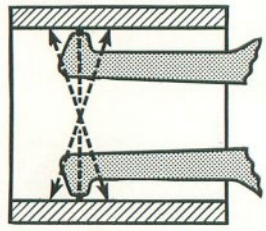


MODEL 149 SERIES

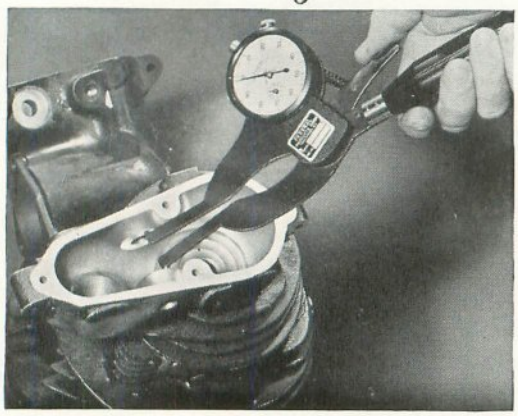


MODEL 149 P-20

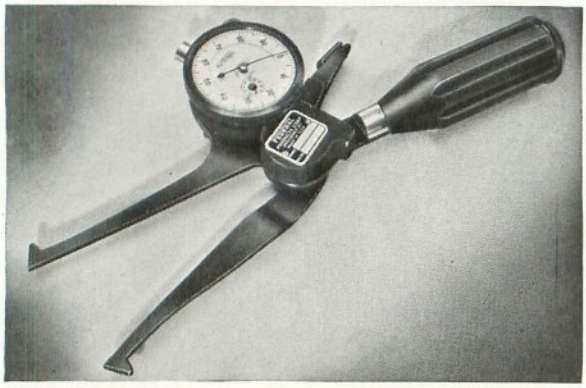
PATENTED



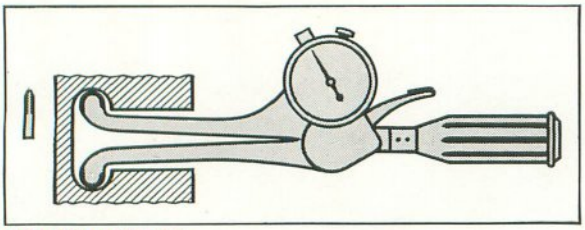
A SLIGHT "ROCKING" of the gage is required to position the contact squarely across the desired dimension.



ALL TYPES of rough inspection can be made fast and conveniently with these caliper type indicating gages.



MODEL 149P-32
checks inside diameters and has a maximum measuring depth of 4".



MODEL 149P-38
checks the diameter of a recess. Note the special contacts to meet the specific requirements of the job.

CALIPER GAGE
for Inside Dimensions

The Model 149 Caliper Type Indicating Gages are very popular gages. They are very adaptable to all kinds of rough checking. They are fast and convenient. They definitely demonstrate that dimensions do not have to be exceedingly precise in order to be checked more efficiently with Dial Indicators. Work which might ordinarily go unchecked, and so permit indifferent quality standards, is easily and efficiently held to standard through the use of these gages. Patterns, cores, castings, forgings, plastics, dies, glass bottles, sheet materials are but a few of the hundreds of products checked with these gages. An outstanding feature of these gages is their design possibilities. Often a Caliper gage can be made with odd shaped and various length arms permitting checks to be made in all types of places inaccessible to regular gages.

Gages are calibrated to read direct but a slight rocking and rotating motion is required to assure positioning of the gage squarely across the required dimension. Indicators having dial graduations no smaller in value than .010" are recommended for use with these gages.

A stock model as listed is available. However, most requirements demand specially shaped jaws and various sizes. These will be made to suit your needs. Send blueprints or samples of work for designs and prices.

SPECIFICATIONS MODEL 149P-20

Minimum Jaw Opening	7/8"
Maximum Jaw Opening . . .	3 1/16"
Maximum Measuring Depth	1 1/2" in a 7/8" opening
Minimum Graduation of Indicator	.010" or 1/64"
Dial Continuous (Revolution Counter with Double Dial)	0–1000
Weight (Approx.)	1 1/4 lbs.
Furnished in Protective Case	

MODELS 165 AND 166

PATENTED

MODEL 165 P

PLUGS are interchangeable and can be furnished in various diameters and lengths to suit requirements.

PLUG TYPE, PORTABLE INDICATING GAGE with Interchangeable Plugs

Model 165P Portable, Plug-Type, Indicating Hole Gage inspects small holes from $\frac{3}{16}$" up to 1". It is especially adapted to holes under approximately ½" in diameter. It indicates directly the change in diameter and out-of-round, bellmouth and taper conditions of the hole.

The plug-type measuring head has two sensitive contacts positioned diametrically opposite one another. The plug, which is .002" less than the diameter to be checked, serves as a guide and automatically positions these contacts in the hole. As these contacts are diametrically opposite each other, the gage measures direct and can be readily set to a master ring or gage blocks.

Gage is fast and the convenient pistol grip makes it very easy to handle. A slight squeeze on the trigger contracts the contacts which expand simultaneously when the trigger is released. Contacts, in expanded position, are independent of the operator's pressure on the trigger. This assures greater sensitivity and accuracy. Contacts are made of steel and are hardened and polished to provide long wear-life. Special points can be furnished.

Gages are furnished with one plug only for checking the diameter specified and can be used only for checking this specified diameter. Additional plugs can be furnished for any size within the capacity of the gage, but are extra. Plugs also can be furnished in various gaging lengths from 1½" up. But, because of distortion and deflection in very small diameter plugs, only certain maximum lengths are practical for the smaller diameters. All plugs are interchangeable.

SPECIFICATIONS

Note: One plug for the diameter specified is furnished with each gage, other plugs are extra. When ordering, be sure to specify the exact diameter to be inspected.

Indicator Furnished C2I
Metric Indicator Model P1I

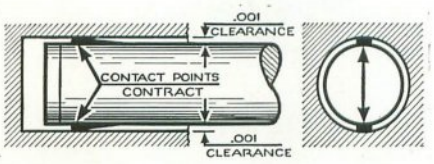
Minimum Graduation . . . . . .0001"
Dial, Balanced (Can be rotated) 0–5–0
Contacts . . Hardened and Polished Steel
Gaging Length (Varies with plug diameter, see table below)

Gaging length will be furnished as listed unless otherwise specified. Other lengths, from 1½", are special.

Any Plug Diameter Within These Dimensions	Furnished in this *Gaging Length	Distance, Contact To End of Plug
$\frac{3}{16}$" to $\frac{3}{8}$" Incl.	$2\frac{3}{4}$"	$\frac{3}{8}$"
Above $\frac{3}{8}$" to $\frac{5}{8}$" Incl.	$3\frac{3}{4}$"	$\frac{3}{8}$"
Above $\frac{5}{8}$" to 1" Incl.	$4\frac{3}{4}$"	$\frac{3}{8}$"

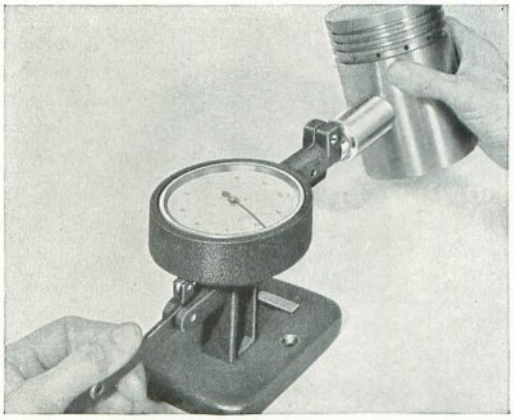
*Distance from contact to shoulder on plug.

YOU CAN SEE the dimensional condition of this hole directly in the Indicator.



PLUG is made approximately .002" less in diameter than the hole to be checked and serves as a guide for positioning the diametrically opposite contacts properly in the hole.

Bottom of blind holes can be inspected with specially designed plugs. Prices on request.



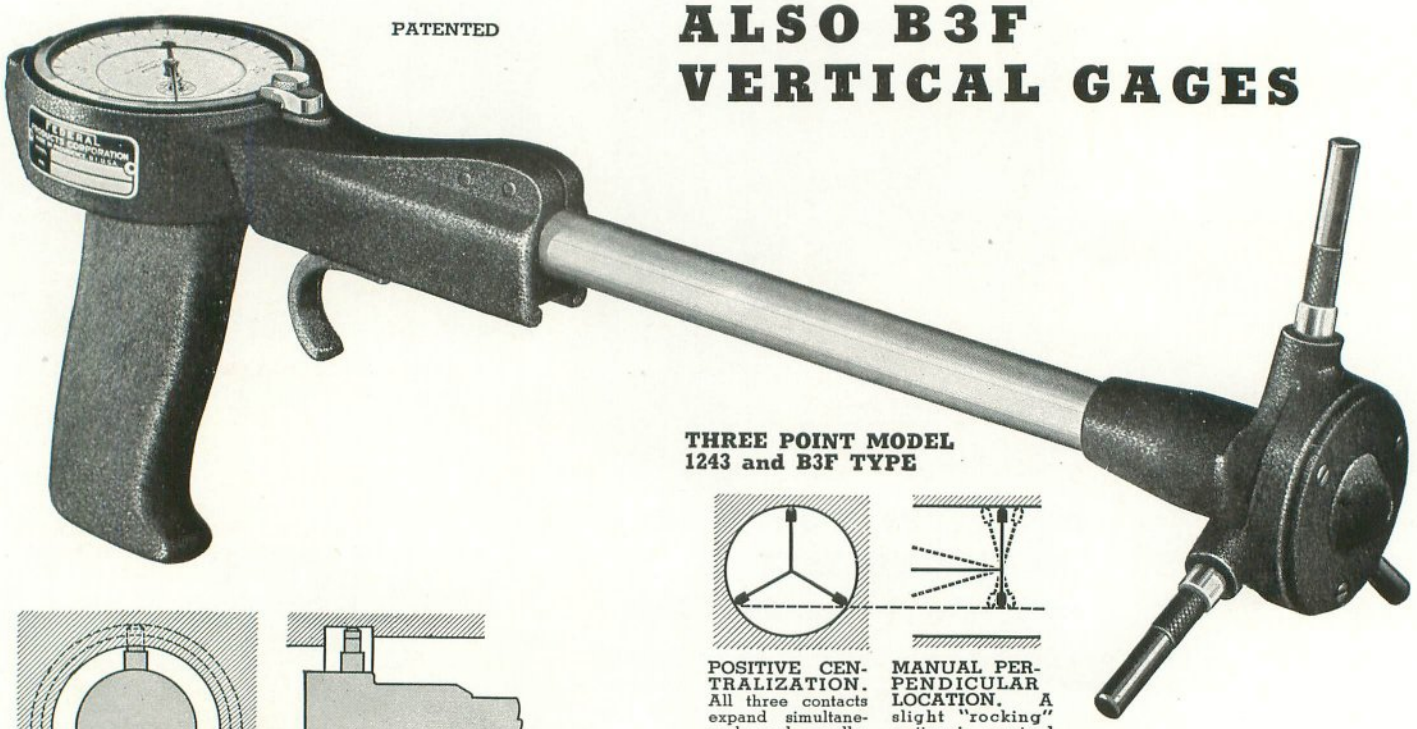
MODEL 166B (Bench Type)

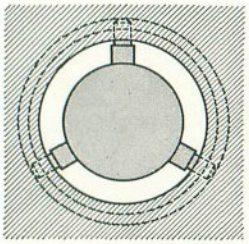
This gage is similar to the Model 165P but is a bench type gage. It makes use of the same interchangeable plugs and has the same features. The contacts on this bench model are retracted by a lever at the end of the gage. Lever can be operated either by hand or by a foot pedal arrangement. Furnished with protecting cover.

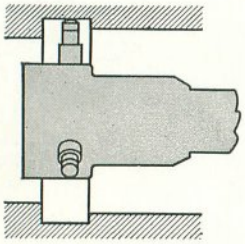
MODEL 1243 AND 1242 SERIES

PATENTED

ALSO B3F VERTICAL GAGES







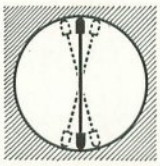
CONTACTS can be contracted to allow them to pass through smaller opening and then allowed to expand to contact the larger diameter or recess.

THREE POINT MODEL 1243 and B3F TYPE

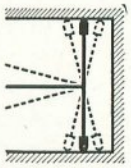
POSITIVE CENTRALIZATION. All three contacts expand simultaneously and equally, thus locating gage centrally in the hole.

MANUAL PERPENDICULAR LOCATION. A slight "rocking" motion is required to obtain the minimum Indicator reading.

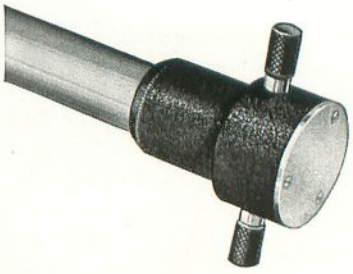
TWO POINT MODEL 1242

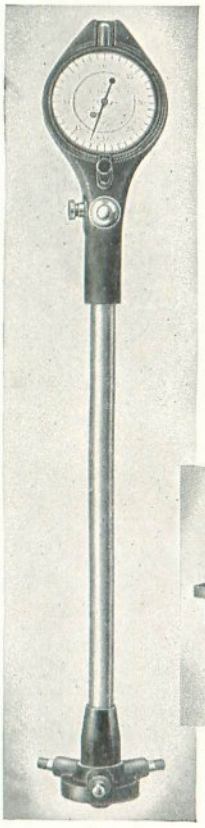


MANUAL CENTRALIZATION. A slight sidewise "rocking" motion is required to center the gage.



MANUAL PERPENDICULAR LOCATION. A slight "rocking" motion is required to obtain minimum Indicator reading.





VERTICAL MODELS B3F

These models are particularly suited to gaging holes and recesses which are more easily inspected in a vertical position. These models are easily gripped below the Indicator leaving the latter in position for convenient reading.

CENTRALIZER sets into top of hole and maintains gaging contacts perpendicular to hole axis. Furnished extra upon request.

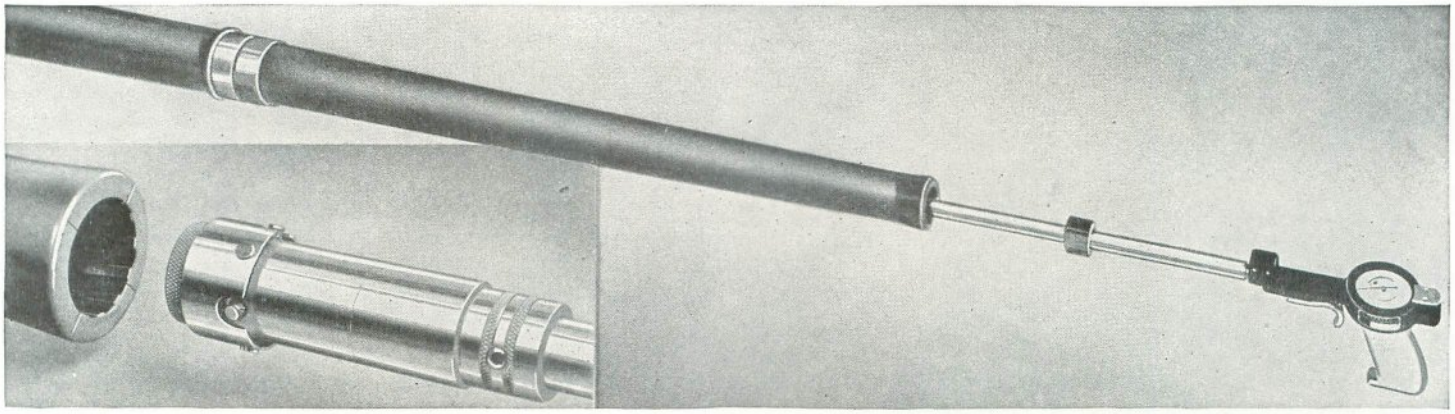
LONG RANGE HOLE GAGES WITH RETRACTING CONTACTS

Model 1243P, 1242P and B3FP Gages differ from our other hole gages in that the long range of their contact points enables them to be retracted while they are inserted into a hole or recess and then expanded so as to contact a *larger* inside hole or recess. (See sketch above.) Their long range also enables them to be used where there is considerable difference between the dimension of the rough and of the finished hole or recess.

Although these gages are not as sensitive as our other hole gages, they will inspect diameters and inside dimensions for size, taper, bellmouth, out of round and other dimensional variations.

They are provided with a handy pistol grip and a trigger which retracts the contact points. The gages can also be furnished with Indicator heads arranged with retracting levers for vertical use. All points retract simultaneously, centralizing themselves in the hole. A slight "rocking" motion is required to secure the minimum or actual diameter reading on the Indicator.

LONG RANGE HOLE GAGES



As the contact can be maintained in the retracted position until the gage is inserted to the gaging location, the danger of marking the surface of the workpiece by dragging the contacts is eliminated.

Contacts are interchangeable and each gage can be furnished with extensions of various lengths to suit gaging dimensions. Contacts are hardened steel, ground and polished.

SPECIFICATIONS

Indicator Model D6K
Metric Indicator, Model Q6I
Minimum Graduation . . . . . .0005"
Dial, Continuous (Double Dial with Revolution Counter) 0–20–0
(Can be rotated)

Contact Points . . . . . Hardened and Polished Steel
One set of Contact Points furnished with each gage. Other sets of contacts are extra.
Points of other material available at extra price.

RANGES AND LENGTHS

The gages are available in sizes and lengths as listed below. Gages having longer ranges, different lengths or special types can be furnished to meet your requirements at special prices. For such cases, please furnish blueprints and complete specifications of your requirements.

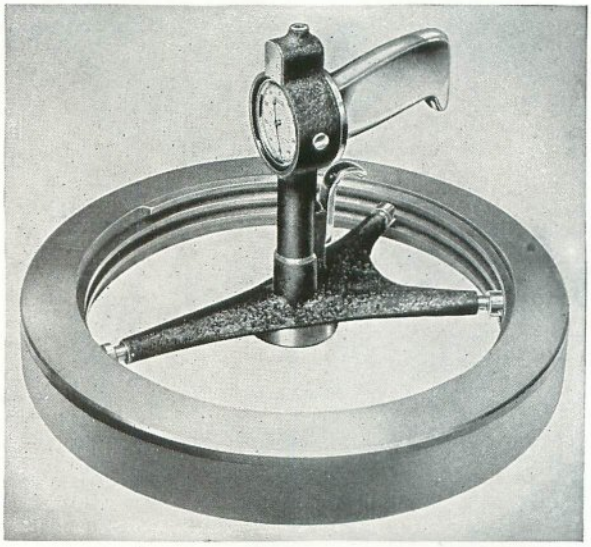
Furnished in wooden case.

MODEL	Total Gaging Range*	Gaging Range of each Set of Cont.	Gaging Length	Dist. Cont. Pt. to End of Head
1242P-1 1243P-1 B3FP-1	.670 — 1.270" Requires six sets of Contacts	.670" — .770" .770" — .870" .870" — .970" .970" — 1.070" 1.070" — 1.170" 1.170" — 1.270"	3" and 6" —B3FP-1— 14"	7/16" 9/16"
1242P-2 1243P-2 B3FP-2	1.250" — 2.750" Requires six sets of Contacts	1.250" — 1.500" 1.500" — 1.750" 1.750" — 2.000" 2.000" — 2.250" 2.250" — 2.500" 2.500" — 2.750"	3" and 6" —B3FP-2— 14"	15/32" 9/16"
1242P-3 1243P-3 B3FP-3	2.750" — 6.250" Requires seven sets of Contacts	2.750" — 3.250" 3.250" — 3.750" 3.750" — 4.250" 4.250" — 4.750" 4.750" — 5.250" 5.250" — 5.750" 5.750" — 6.250"	6" and 12" —B3FP-3— 14"	13/16" 9/16"

*One set of Contact Points furnished with each gage. Other sets of contacts are extra.

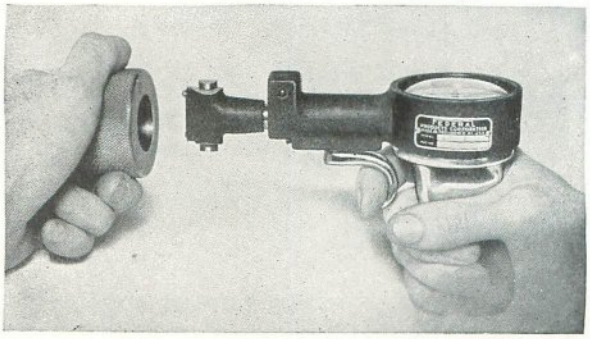
SPECIAL GUN BORE GAGE (PATENTED)

This type of gage very successfully inspects the diameter of both the "lands" and "grooves" of gun bores, from small rifle calibers to large diameter bores and of different lengths. Gaging head rotates with the spiral of the rifling smoothly and sensitively.



SPECIAL MODEL 1243

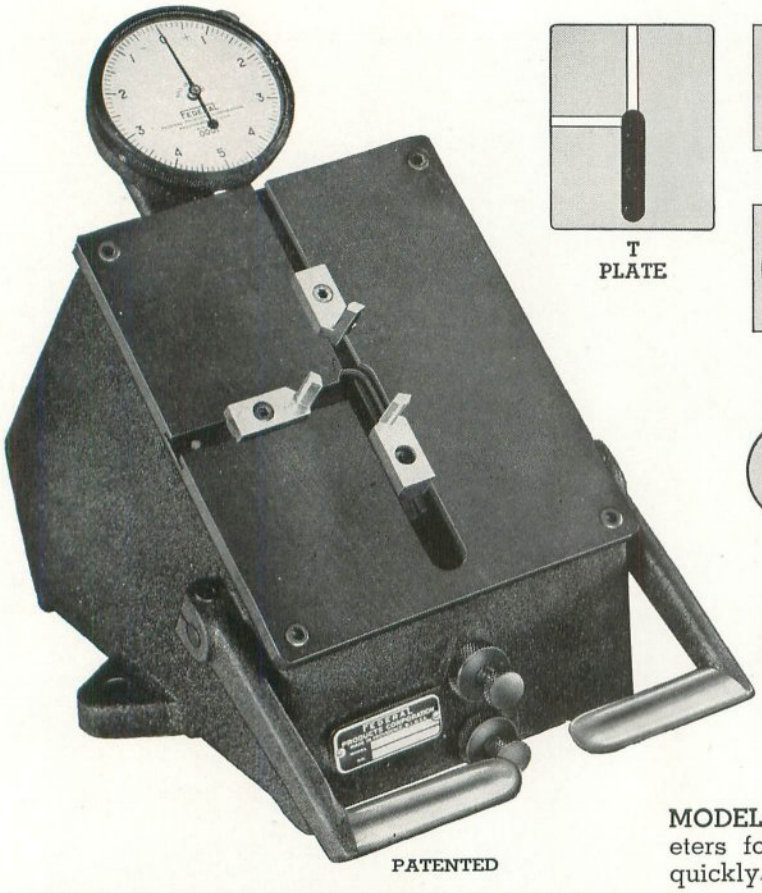
which inspects the inside diameter of an internal worm. Contacts have generated threads.



SPECIAL MODEL 1242

This two point contact gage illustration shows gage applied to master.

MODEL 36B-6



PATENTED

T
PLATE

T 1

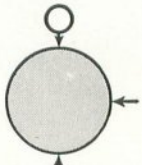
TWO-POINT, INSIDE DIAMETER

Holes smaller than 5/16" diameter are inspected with this arrangement though it may be used for larger diameters. The lower contact is the sensitive one. Hence, the weight of the workpiece rests upon the upper fixed reference contact.

T 2

THREE-POINT, INSIDE DIAMETER

This arrangement is similar to the above except that a third locating contact is provided for use on holes larger than 5/16". This contact locates the workpiece diametrically across the center of the hole.



T 3

THREE-POINT, OUTSIDE DIAMETER

In this case the T Plate and the sensitive contact positions are reversed. The fixed contact is below and again it supports the weight of the workpiece.

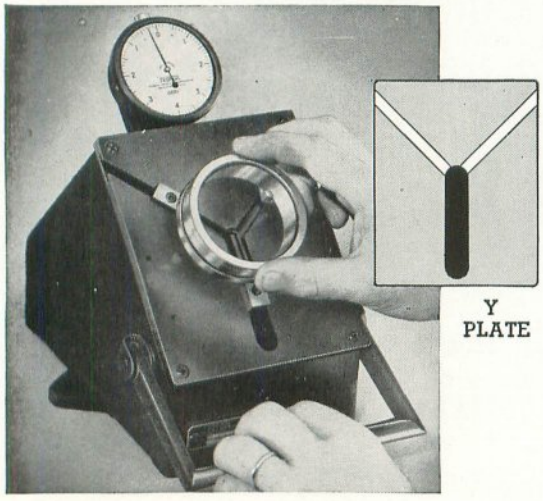
INTERNAL AND EXTERNAL COMPARATOR
with Adjustable Contact Pressure

MODEL 36B-6 Bench Gage will inspect either inside or outside diameters for either production or final inspection, conveniently and quickly.

The contact points are retracted while the workpiece is placed in position, by pressing on either of the finger levers located at the front of the gage. This eliminates the possibility of marring fine work surfaces.

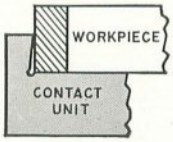
The gage has great sensitivity and fidelity because the movement of the sensitive contact is transferred directly and without lost motion through a non-friction unit to the Indicator.

The pressure exerted by these contacts on the workpiece can be adjusted to suit requirements so that thin walled pieces will not be distorted. The upper thumb screw in front of the base adjusts this pressure. The lower screw controls the amount of contraction of the sensitive contact. The workpiece rests on the shoulder of each contact unit while the actual measuring contacts touch the work at three single points. The location of these points of contact, with relation to the face of the workpiece, can be altered to suit requirements. See sketch.



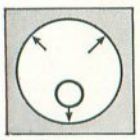
Y
PLATE

Y PLATE. Conditions sometimes require the Y Plate arrangement illustrated at left.



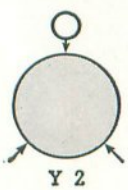
The Model 36B-6 is provided with either of two types of gaging contact arrangements; called the T Plate, and the Y Plate arrangement as explained in the following paragraphs. The position of either plate when used for outside diameter inspection is the reverse of that used for inside inspection.

THE T PLATE arrangement (see illustrations above) inspects diameters directly across the hole. Because of this fact it is recommended for most inside and outside diameter inspection requirements. To inspect I.Ds. smaller than 5/16" diam. two contacts only are used as illustrated. The workpiece is "rocked" slightly on the contacts to obtain the maximum reading. On holes larger than 5/16" diam., a third contact is used as a side stop to locate the hole diametrically across the center. See schematic illustrations above. For outside diameters the T Plate and the position of the sensitive and reference



Y 1

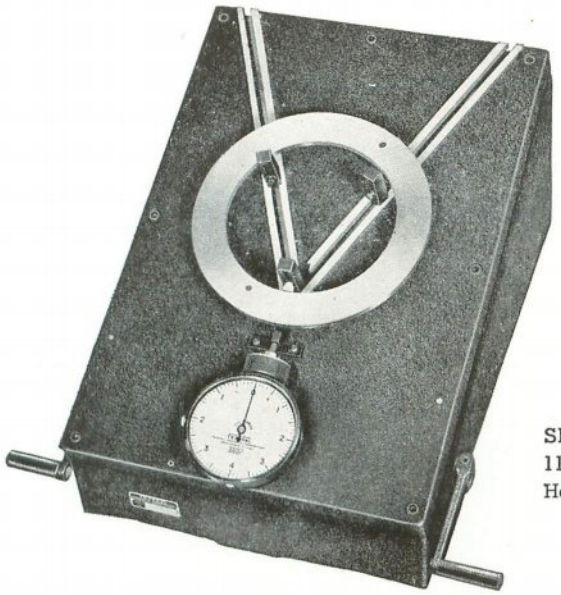
THREE-POINT INSIDE DIAMETER. This three-point arrangement compares diameters *indirectly* as compared with the T Plate.



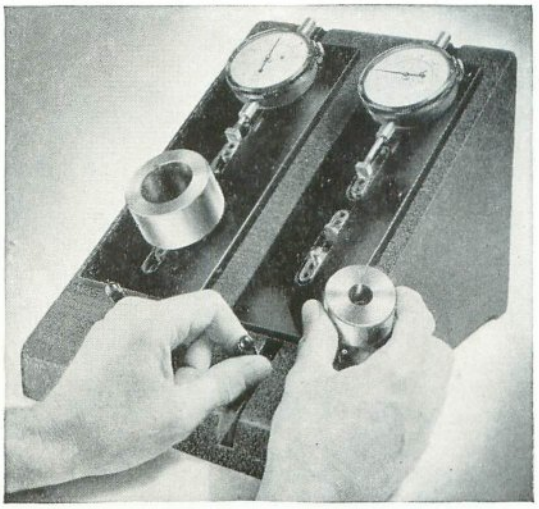
Y 2

THREE-POINT OUTSIDE DIAMETER. Here the position of the Y Plate and the points is reversed. The weight of the workpiece always rests on the fixed reference contacts.

MODEL 36B-6



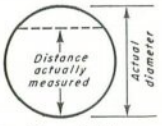
SPECIAL LARGE MODEL 36B-11 for diameters from 2½" to 10". Has Super-Sensitive Indicator.



This model rough inspects wire dies; units measure direct to .001".

contacts are reversed. The contacts can be set by means of gage blocks or micrometers, but for more critically precise work a master ring gage is recommended.

THE Y PLATE arrangement can be furnished for certain requirements when necessary. With this arrangement, three contacts are used: two locating and a sensitive contact. With the Y Plate the diameter is not measured directly. Instead (see drawing) the distance *between the chord* which joins the two locating contacts and the sensitive contact is measured. Therefore, it is very necessary that all three contacts be located precisely equidistant from the center of the hole. Since the amount of variation shown on the dial is the distance between the chord and the sensitive contact, which is not the actual diameter, a special Dial Indicator is used to compensate for this condition. This enables actual or true variations in diameter to be read on the dial provided all three contacts have been properly spaced equidistant from the center.

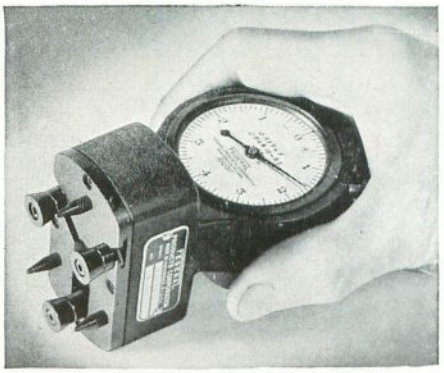


CONTACT POINTS on all types of contacts are made to specific requirements and are designed to suit the diameter and shape of the workpiece. **They are, therefore, furnished as extra equipment.** It is recommended that the height of the contact points, both the sensitive and the locating contacts, should not exceed the diameter of the hole. An exception can be made where the hole is large enough to permit contact jaws large enough to maintain their rigidity.

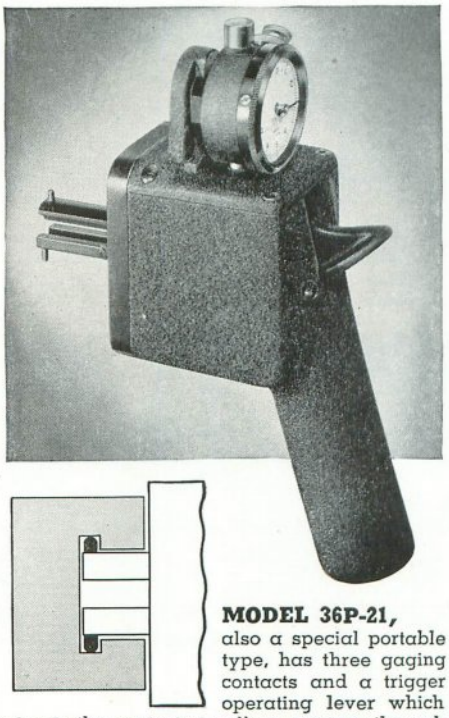
SPECIFICATIONS

Indicator Model (Metric Indicators can be furnished)	T Plate Gage D2I; Y Plate Gage D2K
Minimum Graduation	.0001"
Dial, Balanced (Can be rotated)	T Plate 0–5–0; Y Plate 0–4–0
Contacts, Sensitive and Reference	Made to Specifications
Note (Contacts are made to suit requirements and are charged for as extra)	
Range of Sensitive Contact	.100"
Capacity, Diameter	
T Plate, 2 jaw, 2 contact direct diameter gage	Inside .187" to .3125"
T Plate, 3 jaw, 3 contact direct diameter gage	Inside .3125" to 3.375"; Outside 0 up to 3"
Y Plate, 3 jaw, 3 contact centralizing gage	Inside .375" to 3.375"; Outside 0 up to 3"
Size, Overall (approx.)	6" x 10" x 8¾" high
Weight, Net (approx.)	22 lbs.

Furnished with Protective Cover.

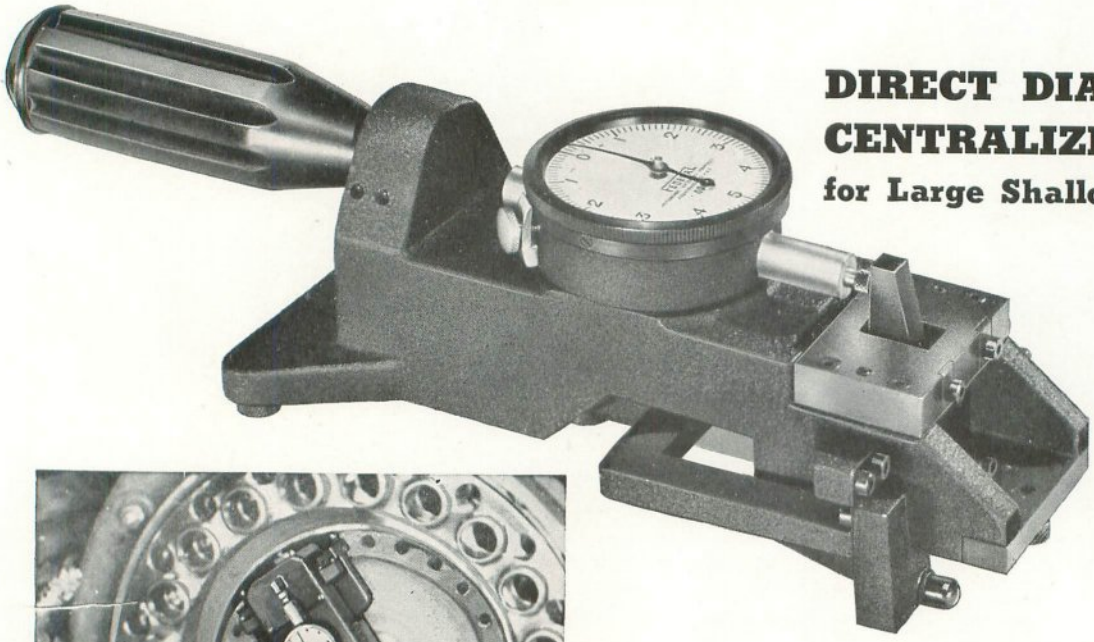


MODEL 36P-18
is a special portable gage built on the same principle as the regular 36B-6. A trigger under the Indicator retracts the points.



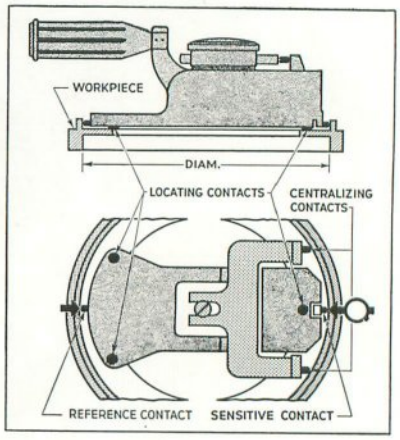
MODEL 36P-21,
also a special portable type, has three gaging contacts and a trigger operating lever which retracts the contacts to allow passage through the hole opening. The long contacts then reach down into the larger diameter.

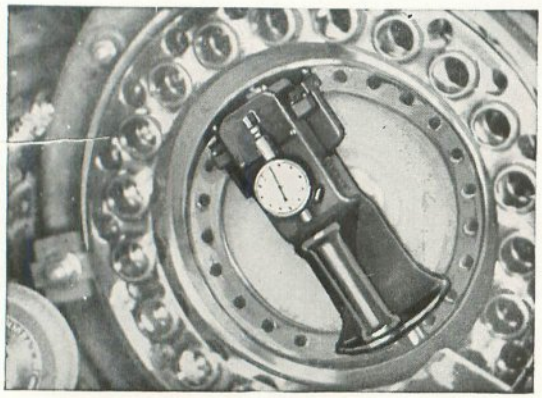
MODEL 167 SERIES



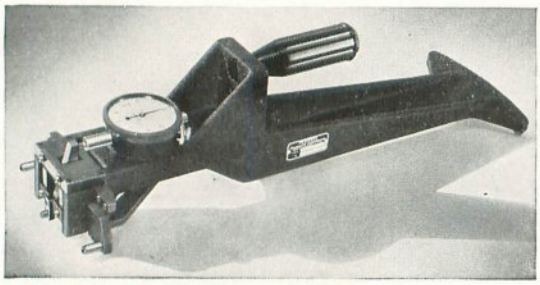
DIRECT DIAMETER CENTRALIZING HOLE GAGE

for Large Shallow Holes

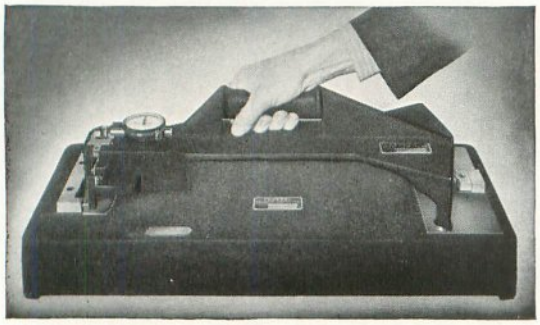




MODEL 167P TYPE GAGE
is easily applied to workpieces held in a machine. This makes positive and accurate inspection during production, without removing work from the machine.



THIS LARGE MODEL 167P-100
is as easy to handle as the smaller models. Note the convenient position of the handle in relation to the dial. Gages are well balanced.



MODEL 167P-66 GAGE
checks an inside diameter of 19.360". The bridge type frame permits gage to be used over a center hub. Illustration shows gage applied to master.

Model 167P Gages are single-purpose, self-locating gages for inspecting inside diameters of large, shallow holes directly. They are special design gages built to suit your particular requirements.

Large, shallow holes are not the easiest to inspect accurately but this gage locates itself positively on a three point contact, against the face or shoulders of the workpiece, perpendicular to the axis of the hole. These three locating points also determine the depth at which the diameter is inspected. A two-point, frictionless suspended centering unit locates the gaging contacts diametrically across the center of the hole.

The sensitive contact point transfers its movement directly to the Indicator by a frictionless unit, without any loss of motion. There is no chance for wear in this unit and it also protects the Indicator from side thrusts and shock which would otherwise influence the accuracy of the inspection and possibly damage the Indicator.

SPECIFICATIONS

These gages are made special for each individual application. For complete specifications, send detailed information pertaining to the part to be gaged, including blueprints and sample part.

Indicator Model . . . . . Metric Indicator, Model P1I	C2I
Minimum Graduation	.0001"
Range	.025"
Dial, Balanced (Can be rotated)	0–5–0

MODEL 110B-3

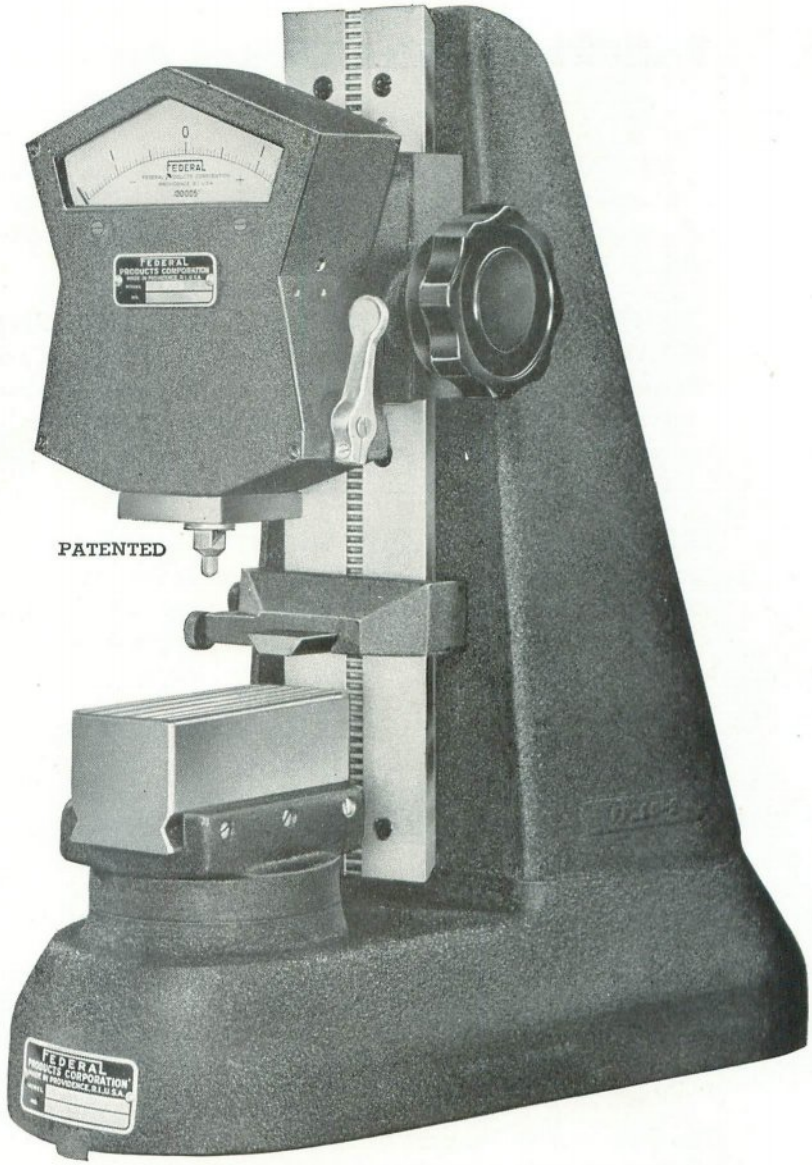
CLEAR WIDE-SPACED GRADUATIONS. Illustration of dial actual size.

SUPER-SENSITIVE COMPARATOR

The Model 110B-3 Comparator is a super-sensitive instrument of high precision. Its Super-Sensitive Low-Friction Indicator has exceptionally accurate repetitive qualities. It is graduated in .00005" and has light contact pressure. The Indicator is entirely sealed from all dust. Fine adjustment of the sensitive contact point is an integral part of the Indicator. See lever at side. Approximate setting of Indicator is provided by rack and gear, and knob on the left side locks the bracket in position.

The heavy, rugged frame is extremely rigid to insure high accuracy. The adjustable backstop, which is available as extra equipment, is simple and positive. Anvils are furnished as extra equipment.

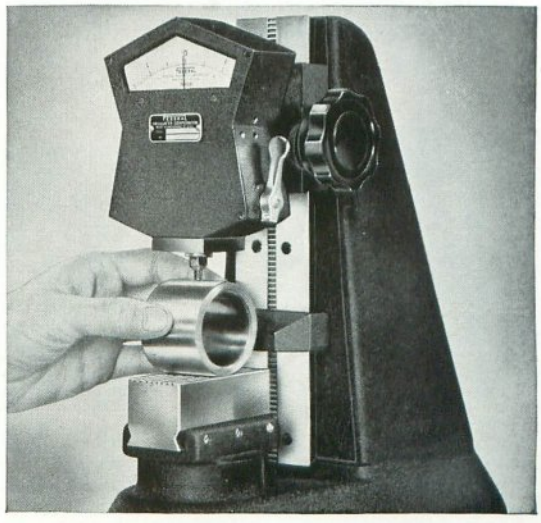
The regular hardened reference anvil is serrated with .035" serrations. Its working surface is ground and lapped flat to within one-half wave length of light over 60% of its area. Other special reference anvils made to your requirements can be furnished at special prices.



SPECIFICATIONS

Indicator Model	H0EB
Metric Indicator Model U0ZB	
Minimum Graduation	.00005"
Range (total)	.003"
Dial (Balanced)	± .0015"
Maximum Vertical Capacity (Contact Point to Reference Anvil)	3.750"
Maximum Throat Depth (Contact Point to Vertical Slide)	2.500"
Sensitive Contact	Diamond Tip
Adjustable Backstop	Furnished extra
Reference Anvil (Lapped Surface) (Furnished extra)	3 3/16" x 1½"
Base (Maximum Dimensions)	10¼" x 7⅝"
Total Height	13"
Weight, Net (Approx.)	35 lbs.

Furnished with protecting cover.

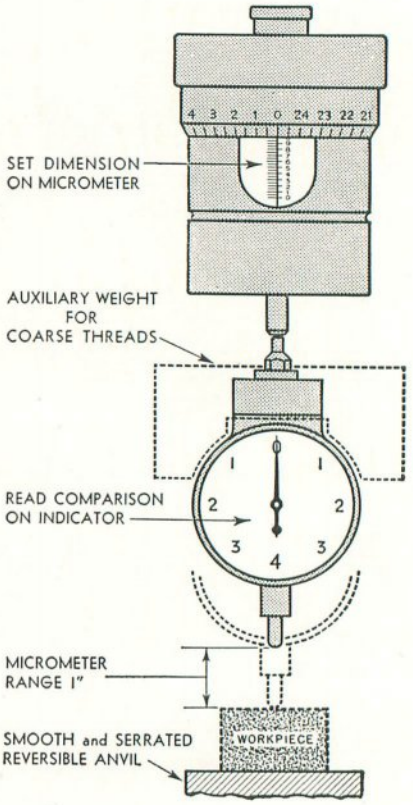


A HIGHLY SENSITIVE and accurate mechanical instrument. Requires no electrical or other connections.

MICROMETER-COMPARATOR

PATENTED

With Three-Wire Thread Attachments



This Model 120B-1 combination Micrometer and Dial Indicator Comparator is a convenient instrument for production inspection and miscellaneous tool room use. It meets a very definite need because of its exceptional versatility. Its outstanding features are as follows:

COMBINATION MICROMETER HEAD AND DIAL INDICATOR COMPARATOR provides a convenient instrument for tool rooms and small shops having miscellaneous job lots of duplicate workpieces. The micrometer head takes the place of gage blocks and the Dial Indicator Comparator provides an instrument which is faster than the usual micrometer. It is also less subject to human variations.

IT INCORPORATES ITS OWN MASTER. The micrometer head eliminates the need for a complete set of gage blocks for setting the Dial Indicator to the required dimension. 1" and 2" gage blocks (furnished as extra) enable you to set the gage by means of the micrometer to any dimension within 4" vertical capacity. Total vertical capacity is 8".

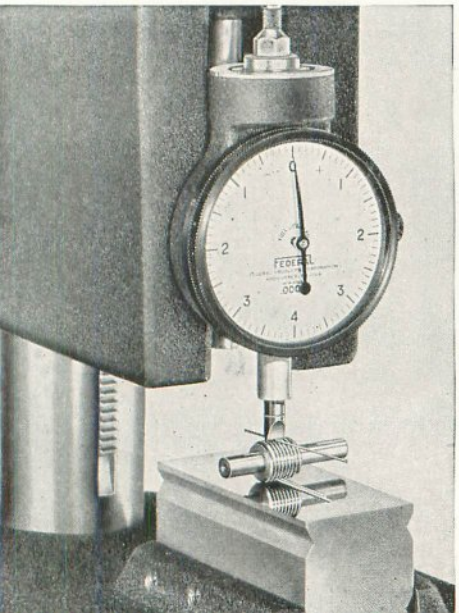
MICROMETER HEAD FACILITATES INSPECTION of thread pitch diameters by the three-wire method and by the usual three-wire formula. An auxiliary weight furnishes the additional pressure required for threads coarser than 20 T.P.I. This weight and a chisel-shaped sensitive contact are furnished as extras.

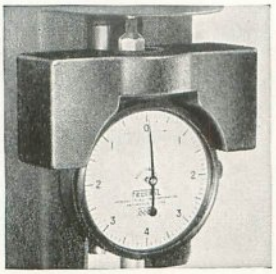
It is equipped with a Federal Super-Sensitive Low Friction Dial Indicator graduated in .0001" having high repetitive accuracy. The Indicator contact pressure is extremely light and sensitive.

The large diameter of the Micrometer thimble permits graduations of .0001" directly on the thimble.

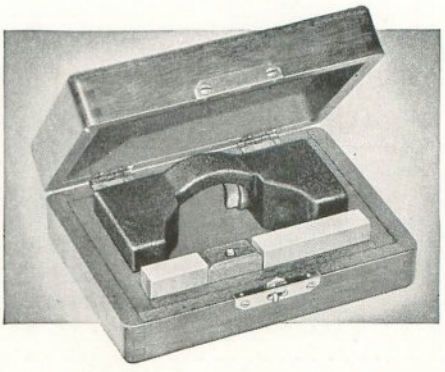
The Micrometer-Comparator is also used for Direct Measuring with a constant contact pressure by setting the Dial Indicator at zero and using that position as a reference.

The gaging unit, supported on a rigid 2" column is quickly adjusted to gaging position by a rack and pinion and handwheel. A brake prevents the head from dropping. A certain amount of lateral adjustment or swing of the head makes it possible to set the sensitive contact at various positions from edge to edge of the anvil as required. It is furnished with a reversible anvil, smooth on one side and serrated on the other. It is ground and lapped flat. The backstop is adjustable for height and also for depth.

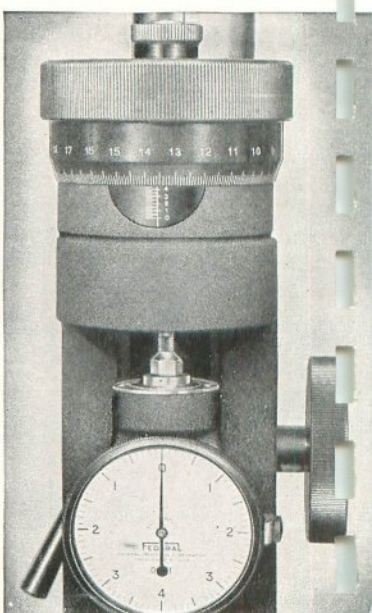




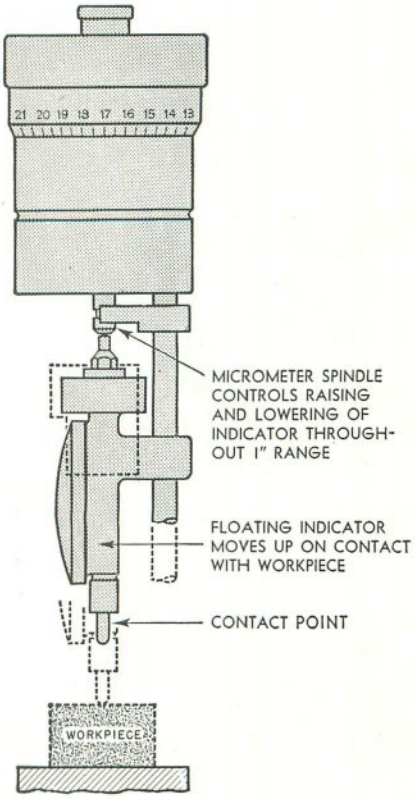
INSPECTING accuracy of pitch diameter by the 3-wire method is ideal with the Model 120B-1. The weight above furnishes proper pressure for coarser threads.



A CHISEL POINT for thread measuring and the weight for coarse threads are furnished as extra equipment. The 1" and 2" gage blocks for auxiliary setting of the gage for capacities up to 4" are also extra. Either or both combinations can be furnished.



MODEL 120B-1


21 20 19 18 17 16 15 14 13
MICROMETER SPINDLE CONTROLS RAISING AND LOWERING OF INDICATOR THROUGHOUT 1" RANGE
FLOATING INDICATOR MOVES UP ON CONTACT WITH WORKPIECE
CONTACT POINT
WORKPIECE

SPECIFICATIONS

Indicator Model D1KBS
Metric Indicator, Model Q1IBS

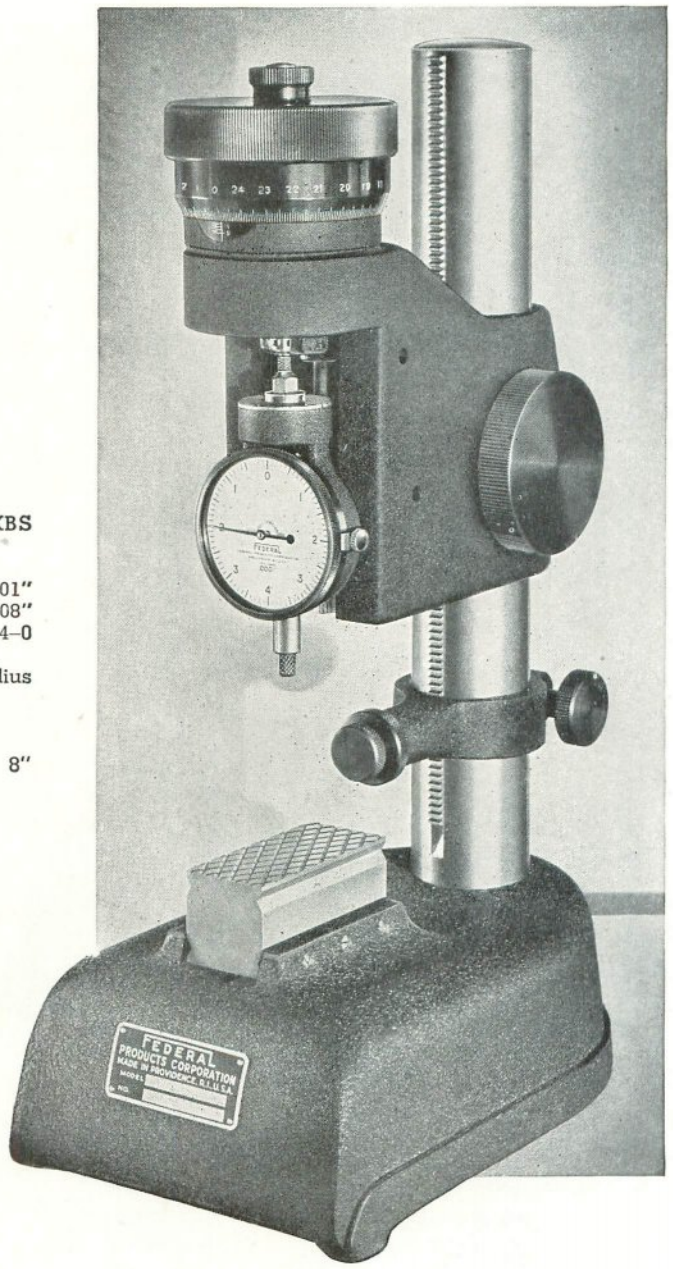
Minimum Graduation . . . . . .0001"
Range . . . . . .008"
Dial, Balanced (Can be rotated) . . . 0–4–0
Sensitive Contact,
Diamond . . . 3/16" Diam., 3/32" contact radius
(Boron Carbide contacts also can be furnished)
Maximum Vertical Capacity (Sensitive Contact to Reference Anvil) . . . . . 8"

Maximum Throat Depth (Sensitive Contact to column) . . . . . 3⅞"
Reference Anvil, Reversible, Ground and Lapped . . . 3 3/16" x 1½"
(One side smooth, opposite side serrated)
Column Diameter . . . . . 2"
Base, Dimensions (Maximum) . . . . . 6½" x 10"
Height, Overall (approx.) . . . . . 18"
Weight, Net (approx.) . . . . . 62 lbs.
Backstop furnished with gage
Gages regularly furnished with protecting cover.

AT-12 THREE WIRE ATTACHMENT, Auxiliary Weight and Chisel-shaped Sensitive Contact Point, furnished extra, with case.

AT-11 ONE AND TWO INCH GAGE BLOCKS enable setting up to 4", furnished extra, with case.

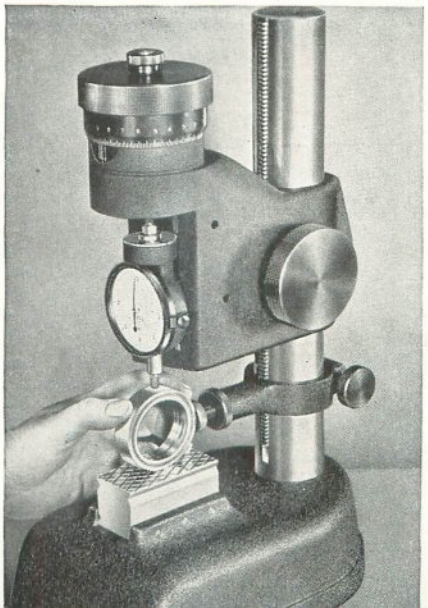
AT-10 COMBINATION of above sets, with case.

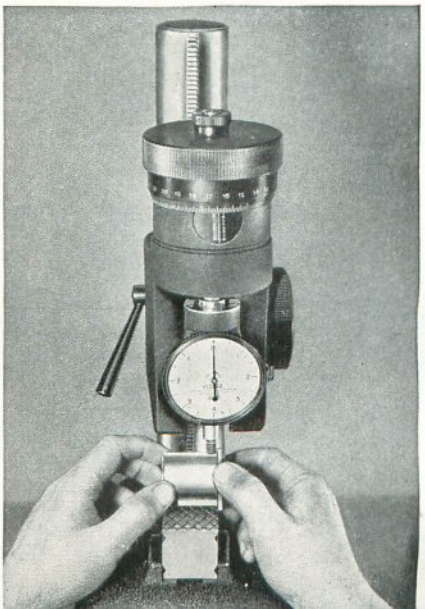


(Left) **THE COMPARATOR** is easily set to required dimensions by means of the micrometer head. Then it is clamped in position *(see arrow above)* and is ready for duplicate inspection.

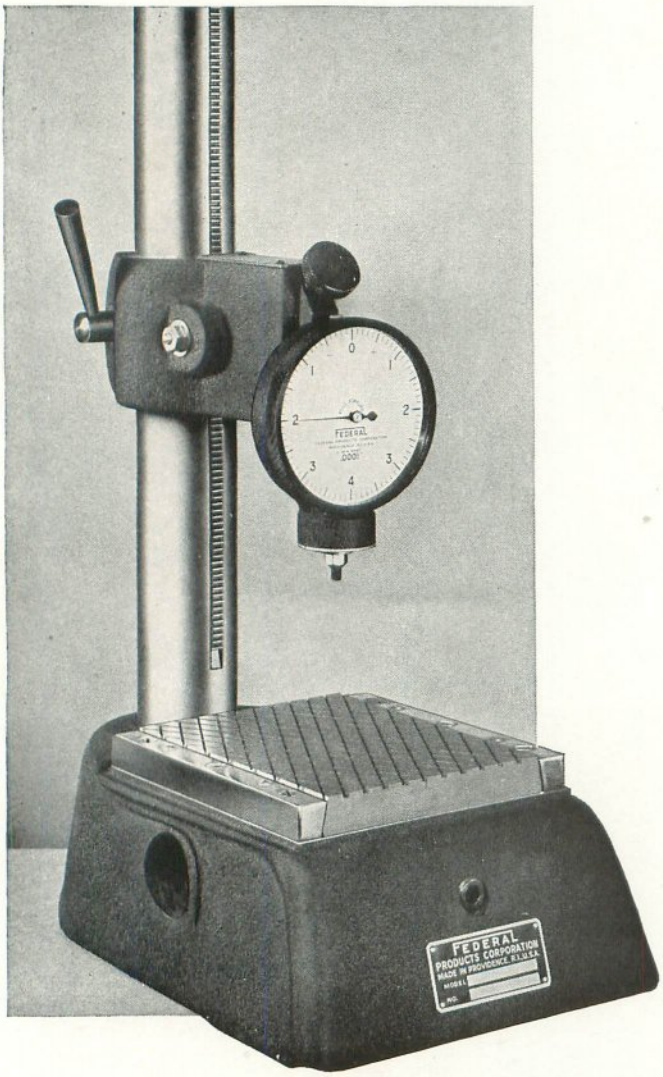
(Right) **MODEL 120B-1** complete with Micrometer Head for setting, Dial Indicator for comparing and backstop for locating work is a most convenient comparator. A brake on the handwheel prevents the head from dropping.

(Extreme right) **THE HEAD** can be swung to either side to enable proper location of flanges, etc., for precise inspection.

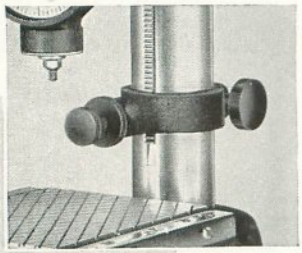


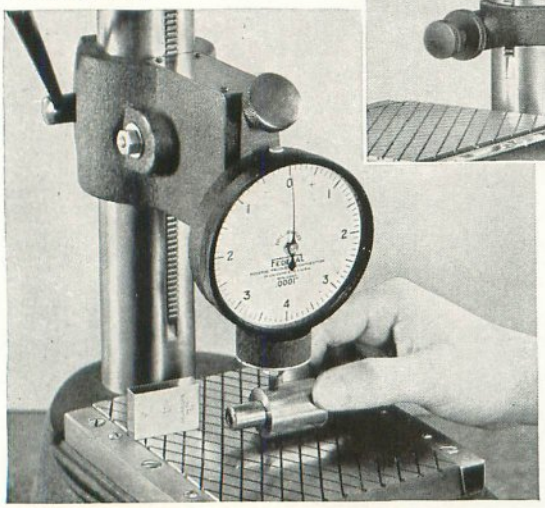


MODEL 100B-20

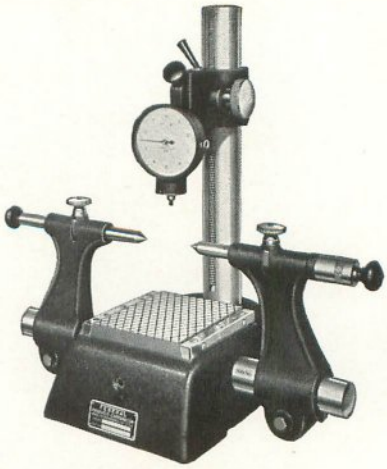


At right, **A BACKSTOP** (furnished extra) speeds up production inspection.





THE INDICATOR compares the workpiece with positive yet sensitive low pressure. **NO BACKLASH** or loose play in this positive, fine adjustment.



CENTER ATTACHMENT, MODEL A–100B–20–3

Adjustable for length. Part is held in position by spring pressure and is removed simply by pulling the right-hand knob and lifting out the part.

ROLLER V BLOCKS ATTACHMENT, MODEL A–100B–20–4

The rollers of this attachment are fixed but can be rotated when necessary to compensate for wear.

UNIVERSAL DIAL COMPARATOR

The Model 100B-20 Comparator is a universal type of instrument. It is provided with a Super-Sensitive Low-Friction type of Indicator which has high repetitive accuracy. Indicator is completely sealed from dust. Contact pressure is exceptionally light. All are important features necessary to high precision inspection.

Fine and positive adjustment of the Indicator is made by the patented adjusting arm. There is no backlash or loose play in the adjustment. Approximate adjustment is made by the rack and gear adjustment.

The accurately ground and lapped serrated reference anvil is removable. The heavy cast iron base supports a large substantial column, making a very rigid universal type of comparator for all around use. Backstop, which is furnished extra, is adjustable to take work up to 3" in diameter.

Attachments as illustrated are readily interchanged. They are available as extra equipment.

SPECIFICATIONS

Indicator Model	E1KB
Metric Indicator Model	R1BB
Minimum Graduation	.0001"
Range	.008"
Dial, Balanced (Can be rotated)	0–4–0
Sensitive Contact Point	Diamond
Maximum Vertical Capacity (Sensitive Contact to Reference Anvil)	9"
Maximum Throat Depth (Sensitive Contact to Post)	3⅞"
Reference Platen (Ground and Lapped Surface)	6" x 4¾" x ⅝" high
Base	7 9/16" x 11½" x 4¼" high
Column Diameter	2"
Weight, Net (Approx.)	67 lbs.

Furnished with protecting cover.

Following Attachments furnished as extra equipment:

CENTER ATTACHMENT, MODEL A-100B-20-3

Maximum distance between centers	8½"
Mounting Bar 18" long x 1½" diameter	
Maximum Vertical Capacity (Sensitive Contact to Center)	5⅞"
Maximum swing of attachment	3½"

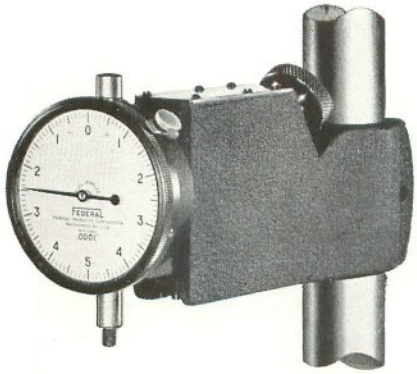
ROLLER V BLOCKS ATTACHMENT MODEL A-100B-20-4

Maximum Length of roller V blocks	7½"
Maximum Vertical Capacity (Sensitive Contact to top of rolls)	7¼"
BACKSTOP	adjustable for work up to 3" dia.

MODEL NB-60

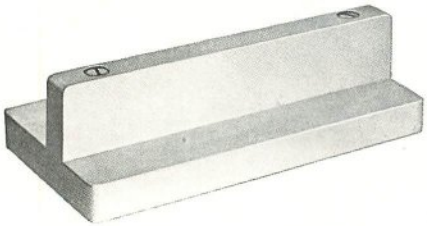
AN-4 FINE ADJUSTMENT ATTACHMENT

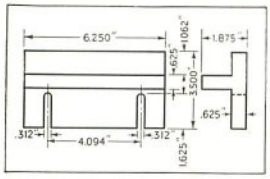
is extra equipment. It provides a convenient and positive fine adjustment for setting the indicator. Range of adjustment .010". Price, attachment without indicator, $20.00 additional. **PATENTED.**

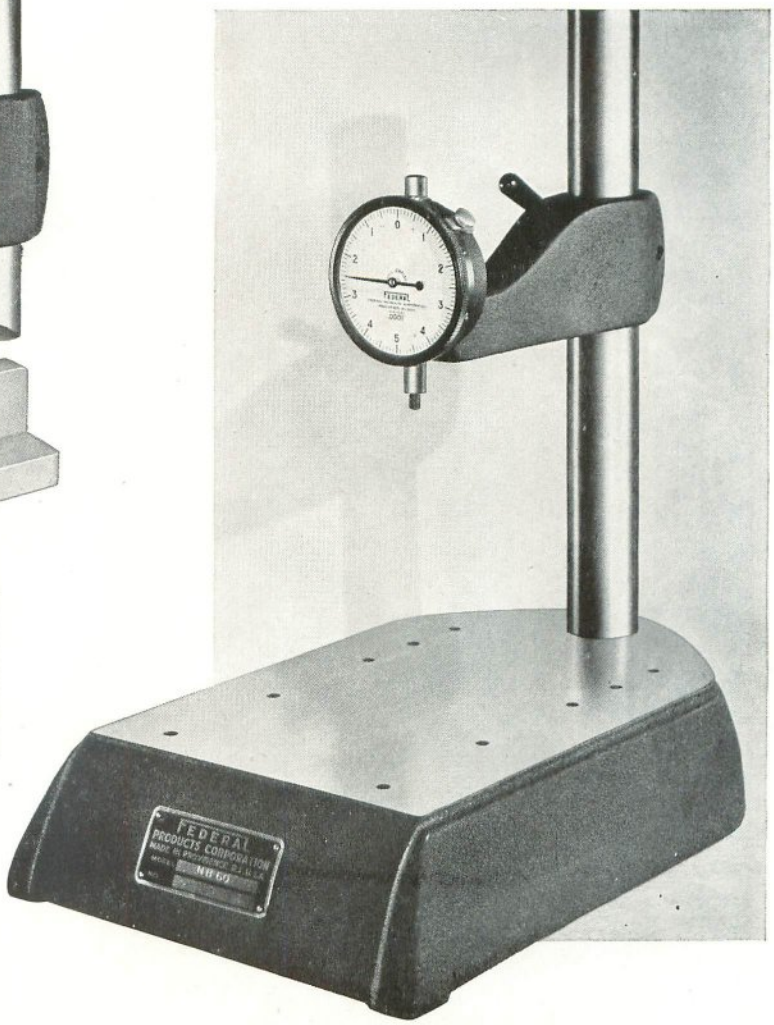


AN-3 BACK STOP ATTACHMENT

is extra equipment. It positions work for inspection and is readily fastened to the platen at practically any position. Price $15 additional.







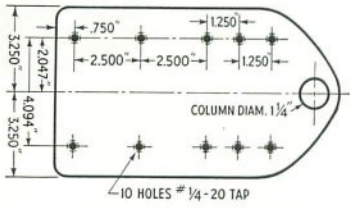
COMPARATOR

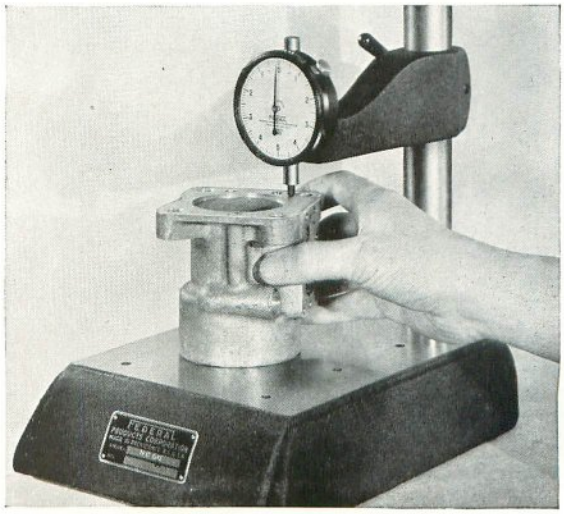
The Model NB-60 Comparator is a general purpose, all-around comparator adaptable to a wide variety of uses in the machine shop, in the tool room and in inspection departments. Its large platen is ground flat. Platen has a series of ten tapped holes to provide an easy means of fastening the AN-3 Backstop Attachment, V Blocks, or any type of special fixture securely to it.

Both column and arm Indicators are rugged to insure rigidity.

A Fine Adjustment Attachment, Model AN-4, designed with a fine adjustment for setting of the Indicator can be furnished if desired but is not included with the comparator.

THE TEN TAPPED HOLES facilitate the mounting of the AN-3 Attachment and other fixtures to the platen.



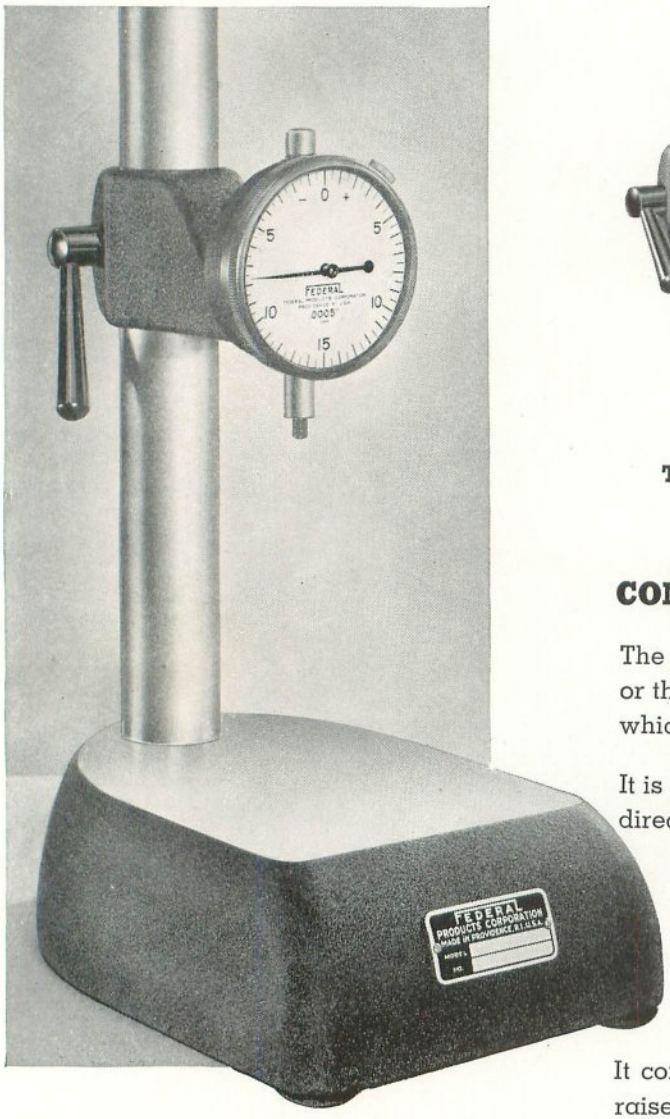


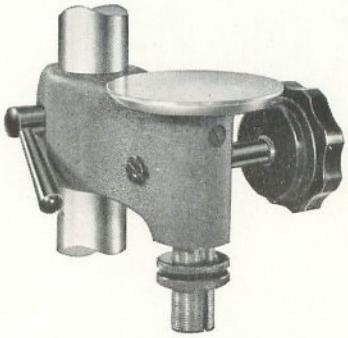
SPECIFICATIONS

Indicator, Model	D2I
Metric Indicator Model Q1I	
Minimum Graduation	.0001"
Range	.025"
Dial, Balanced (Can be rotated)	0–5–0
Sensitive Contact	Hardened Steel
Maximum Vertical Capacity (Contact Point to Reference Anvil)	8"
Maximum Throat Depth (Contact Point to Column)	4⅞"
Reference Platen (Ground Surface)	9⅜" long x 6½" wide
Tapped Holes (10)	¼"–20
Column Diameter	1¼"
Height Overall	14½"
Weight (Approx.)	31 lbs.

Furnished with protecting cover.

MODEL 35B-30





ADJUSTABLE TABLE ATTACHMENT

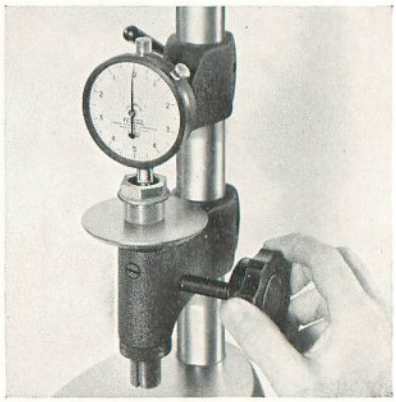


TABLE can be lowered to enable work to be placed under contact point. Then raised to gaging position. Furnished as extra equipment.

COMPARATOR OR THICKNESS GAGE

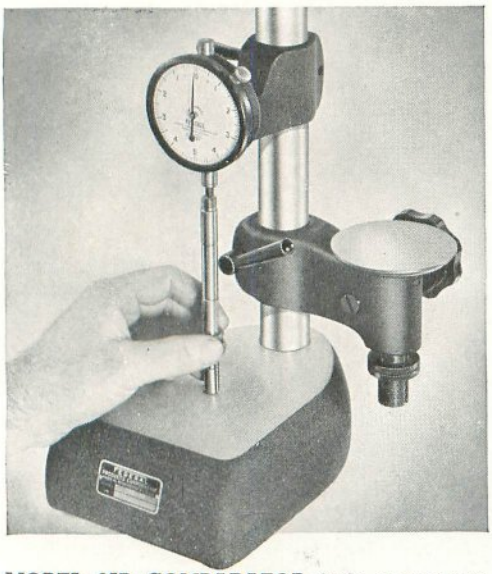
The Model 35B-30 readily adapts itself for use as either a comparator or thickness gage. Its solid yet simple base also makes it an instrument which can be easily modified to suit special requirements.

It is easily portable and convenient to use on either bench inspection or directly at a machine for production inspection. It is a rigid, positive instrument, though it is comparatively small.

The base is substantial and the column and Indicator supporting arm are rugged and rigid. Adjustment of the Indicator arm on the column is made directly by a lever type clamp.

Adjustable Table Attachment is available as extra equipment. It converts instrument to a convenient thickness gage. The large knob raises and lowers the table. Adjustable stop beneath table locates table at measuring point. This makes it possible to check many parts that could not be reached with fixed spindle comparator. See illustration. Table can be readily swung aside when not required.

Modifications of this gage may be had to adapt it for single-purpose requirements by the addition of special reference or supporting anvils, higher column or other devices.



MODEL 35B COMPARATOR finds many uses around the machine shop, both as a production comparator and an inspection comparator. Its small size makes it readily portable.

SPECIFICATIONS

Indicator Model	D5M
Metric Indicator Model	Q6I
Minimum Graduation	.0005"
Range	.075"
Dial, Balanced (Can be rotated)	0–15–0
Sensitive Contact	Hardened Steel
Maximum Vertical Capacity (Sensitive Contact to Reference Anvil)	8¾"
Maximum Throat Depth (Sensitive Contact to Post)	2½"
Reference Platen (Ground Surface)	4½" x 4⅞"
Column Diameter	1¼"
Height, Overall	14½"
Weight, Net (Approx.)	18¼ lbs.

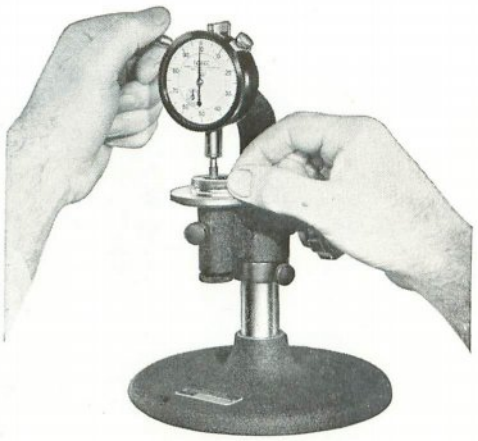
Furnished with protecting cover.

ADJUSTABLE TABLE ATTACHMENT SPECIFICATIONS

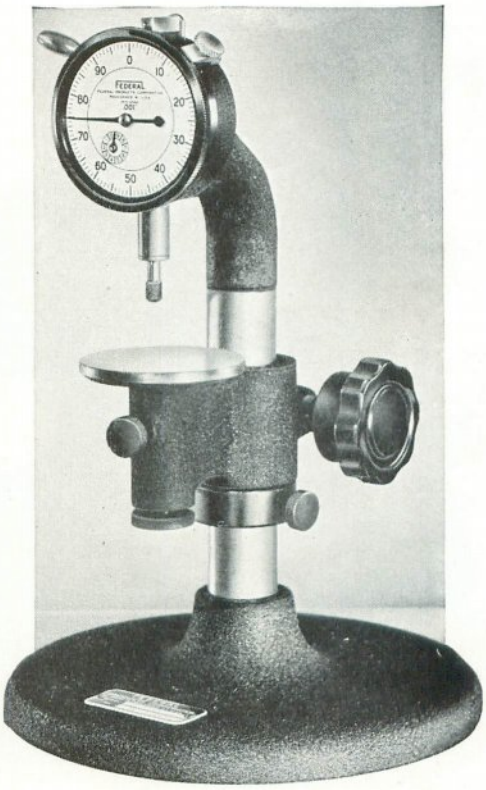
(Furnished as extra equipment)

Table Diameter (Ground Surface)	3"
Maximum Vertical Table Movement	1"
Maximum Vertical Capacity (Sensitive Contact to Table Surface)	4½"

MODEL 35B-8



MODEL 35B-8 THICKNESS COMPARATOR being used as a production gage. Note the convenient left-hand position of the lifting lever which leaves the right hand free to control the workpieces.



COMPARATOR OR THICKNESS GAGE

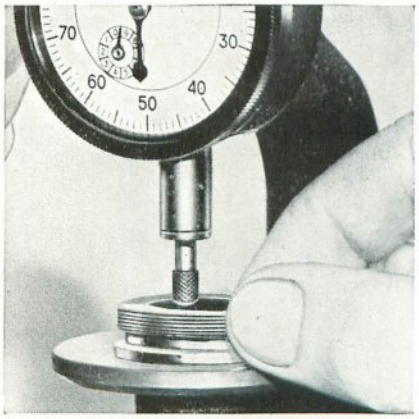
The Model 35B-8 is a comparatively small type of general purpose bench gage for inspecting the thickness of small parts. The Indicator regularly furnished is provided with a lifting lever which permits irregular or cupped shape pieces to be inspected as quickly and easily as flat pieces. Or, a Balanced-type Indicator may be furnished for *comparing* the dimensions of the workpieces.

The table is roughly set for position on the post by the hand screw and a vertical adjustment of the table is provided under the table for fine setting. The table bracket is also supported by a collar which permits swinging the table to either side.

Although a comparatively small gage, it is rigidly constructed.

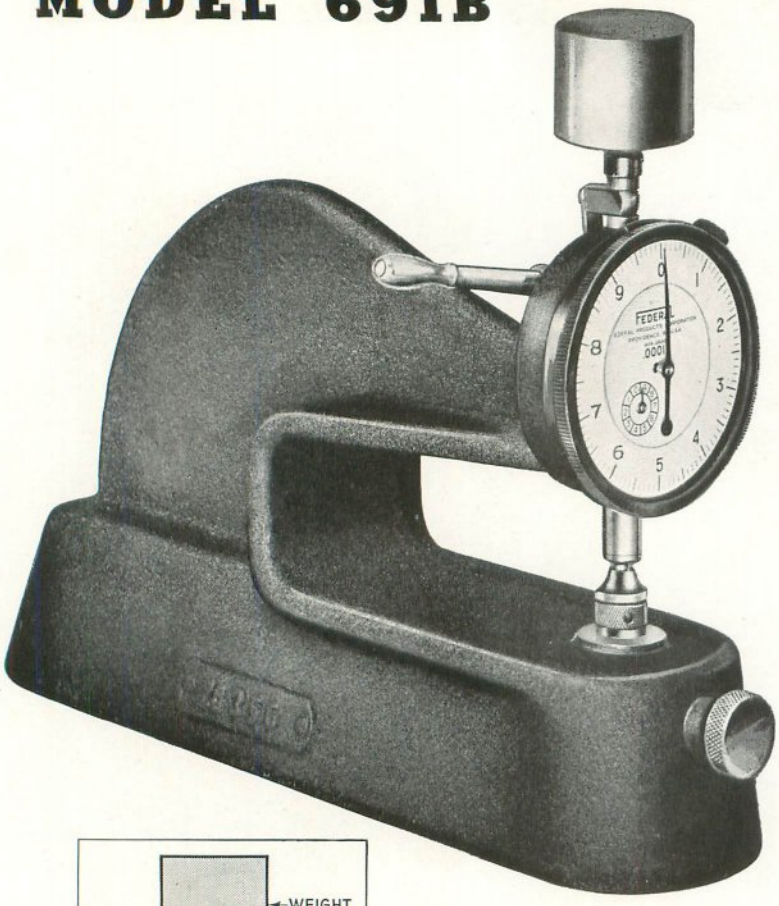
SPECIFICATIONS

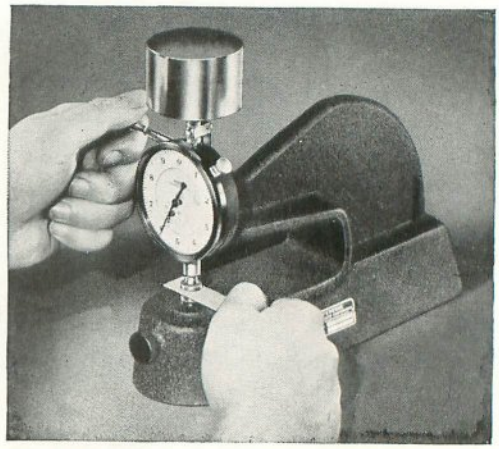
Indicator Model	C81
Metric Indicator, Model P6I	
Minimum Graduation	.001"
Range	.250"
Dial, Continuous (Revolution Counter with Double Dial—Can be rotated)	0–100
Maximum Vertical Capacity (Sensitive Contact Point to Reference Anvil)	2"
Maximum Throat Depth (Sensitive Contact Point to Post)	1½"
Reference Table (Ground Surface), diameter	2"
Reference Table, vertical adjustment	3/16"
Column Diameter	⅞"
Base Diameter	6"
Height, Overall	9"
Weight, Net (Approx.) Furnished with protecting cover.	6 lbs.



RANGE OF COMPARATOR permits pieces up to 2" thick to be checked while the range of the indicator combined with the lifting lever permits contact point to enter a cavity up to ¼" deep.

MODEL 691B





LIFTING LEVER does not influence pressure on anvil.

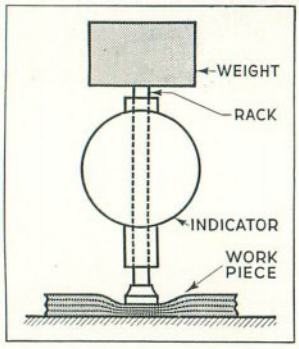
BENCH THICKNESS GAGE

This Model 691B is particularly suited to the measurement of compressible materials such as paper, leather, felt, etc., or any application requiring constant anvil pressure on the material being checked.

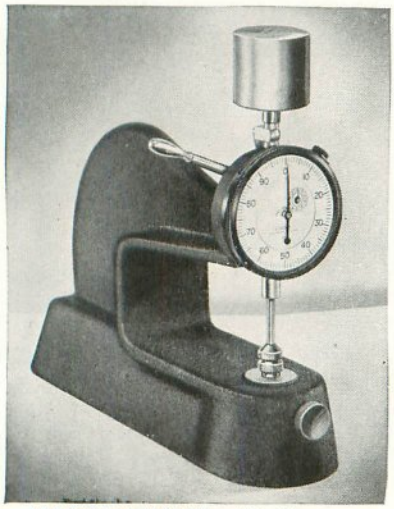
The deep throat allows ample clearance for most work and the ribbed construction of the arm rigidly supports the dial indicator unit.

The use of the weight assures constant pressure throughout the measuring range. Both the contact and reference anvil are lapped flat and parallel to one another. The reference anvil has a slight adjustment. It is adjusted for height by a small screw under the base and is locked securely in position by the thumb screw at the front of the base. Model 691B-28, similar to Model 691B but with a long range Indicator and a slightly larger frame, is also available.

Weights or anvils different from those furnished with the gages can be furnished to meet certain testing standards such as A.S.T.M. or T.A.P.P.I., prices on request.



COMPRESSIBLE MATERIAL should always be inspected with a constant pressure for uniformity of measurement.



MODEL 691B-28 with 1" range

SPECIFICATIONS

	MODEL 691B	MODEL 691B-28
Indicator Model	D2I	D8IS
Metric Indicator can be furnished		
Minimum Graduation	.0001"	.001"
Range	.100"	1"
Dial, Continuous (Revolution Counter with Double Dial). (Balanced Dial optional)	0–10	0–100
Maximum Vertical Capacity (Sensitive Cont. to Ref. Anvil)	.200"	1"
Maximum Throat Depth (Sensitive Cont. to Frame)	4"	4"
Reference Anvil and Sensitive Contact (Steel)	3/8" Dia.	3/8" Dia.
Weight Furnished	10 oz.	10 oz.
Size of Base (Approx.)	10" x 2¾"	10" x 2¾"
Height	8"	9"
Weight, Net (Approx.)	14½ lbs.	15½ lbs.

Furnished with protecting cover.

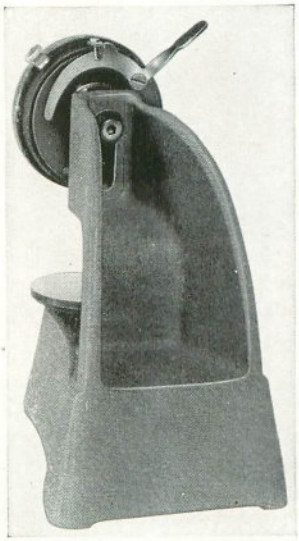
MODELS 57B-1 & 57B-2

SMALL BENCH THICKNESS GAGES

These gages are particularly suited to checking thickness of flat stock such as paper, rubber, fabric, cardboard, textiles, and sheet metal. They are also convenient for measuring miscellaneous small parts. They now incorporate certain design improvements which greatly increase their adaptability and reliability.

The webbed frame of the gage is designed for maximum strength and rigidity. The work platen is accurately ground and firmly bolted to the casting bed. Unlike previous models, the platen is not adjustable vertically; gross adjustment being made by locking the Indicator at the desired height with respect to the platen. The frame is machined to accommodate any Indicator with adjustable "sled-type" bracket back. Interchangeability of Indicators is thus an added feature of this Gage. The sled back also provides a more rugged means of clamping the Indicator to the casting.

Both models are regularly furnished with lifting levers (to the left as you face the Gage unless otherwise specified) for easy insertion of stock or parts between contact and platen. A boss with tapped hole (¼"-20) on the underside of the frame allows for anchoring the Gage to the workbench. Weights may be obtained to supply proper gaging pressure for specific industrial requirements.



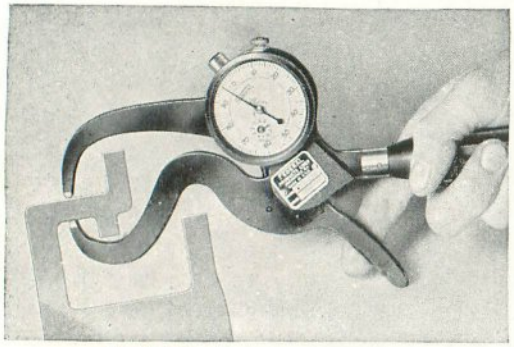
View showing lifting lever, webbed construction and lock screw for vertical adjustment of indicator.

SPECIFICATIONS

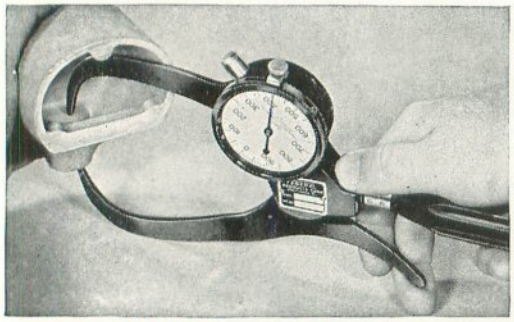
	MODEL 57-B1	MODEL 57-B2
Indicator Model (Full Jeweled and with Lifting Lever. Metric Indicators can also be furnished.)	D8IS	D7I
Minimum graduation	.001″	.0005″
Range	1.000″	.500″
Dial, Continuous (With Revolution Counter and Double Dial)	0–100	0–50
Maximum Vertical Capacity (Sensitive Contact to Platen)	1″	1″
Maximum Throat Depth (Sensitive Contact to Frame)	2 7/16″	2 7/16″
Vertical Adjustment, Indicator	1″	1″
Platen Diameter, Reference	2 1/8″	2 1/8″
*Sensitive Contact Point (3/16″ diam., 3/16″ Contact Radius)	Reg.	Reg.
Height (approx.)	7 1/4″	6 1/2″
Weight, Net (approx.) Furnished with protective cover	7 lbs.	7 lbs.

*Special flat sensitive contacts or presser feet can be furnished to meet various specifications. Prices and information on request.

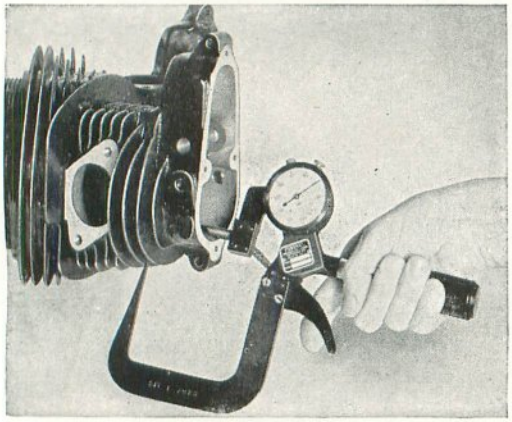
MODEL 49 SERIES



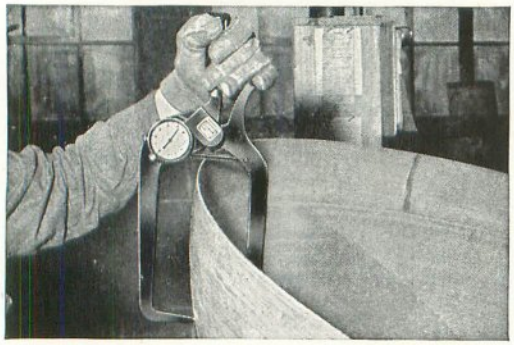
MODEL 49 with jaws designed to clear an obstruction.



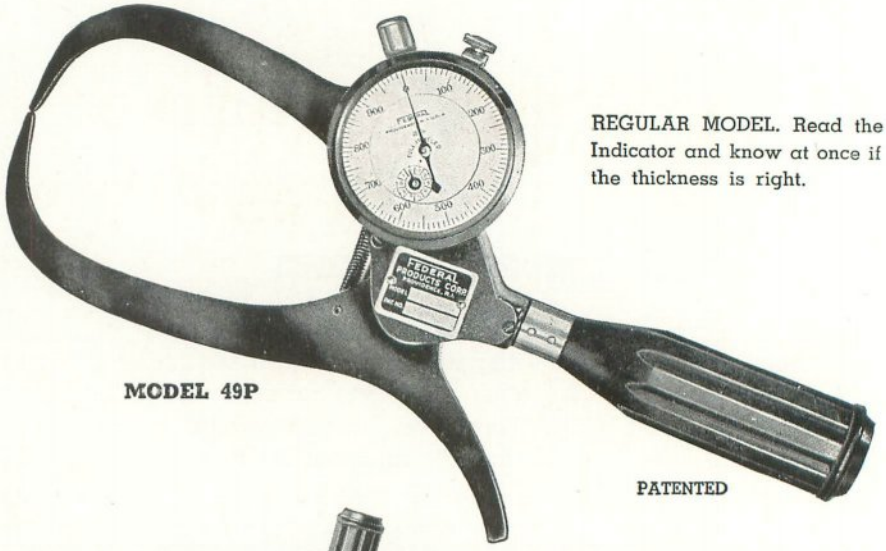
YOU CAN INSPECT rough dimension faster with this caliper than with any other type of caliper.



THIS MODEL 49 is designed so that the jaws fit between the fins of an airplane cylinder to measure wall thickness between the bottom of the fins and the bore.



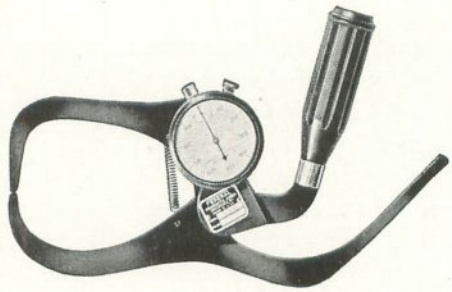
MEASURING wall thickness of a spun bowl.



MODEL 49P

REGULAR MODEL. Read the Indicator and know at once if the thickness is right.

PATENTED



THE HANDLES on the model at left are designed to enable the gage to check a part with limited clearance.

OUTSIDE DIAMETER CALIPER GAGES

The Model 49 Caliper Type Indicating Gages are among the most popular gaging instruments in use today. They are for all practical purposes a portable comparator adapted to checking the outside dimensions or thickness of many types of articles where the tolerances are not exceedingly close.

They are fast, handy and convenient to use. They definitely demonstrate that dimensions do not have to be exceedingly precise in order to be checked more efficiently with Dial Indicators. Work which might ordinarily go unchecked and so permit indifferent quality standards, is easily and efficiently held to standard by the use of these gages. Patterns, cores, castings, forgings, plastics, dies, glass bottles, sheet material are but a few of hundreds of products checked by these gages. An outstanding feature of these gages is their design possibilities. Often caliper gages can be made with odd-shaped and various length arms permitting checks to be made over all types of obstructions.

Gages are calibrated to read direct. A slight rocking motion is required to obtain the minimum reading.

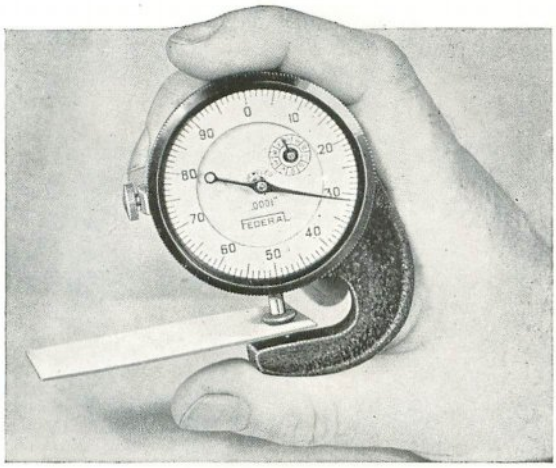
Two stock models are available. However, most requirements demand specially shaped jaws and various sizes. These will be made to suit your needs. Send prints or samples of work for designs and prices.

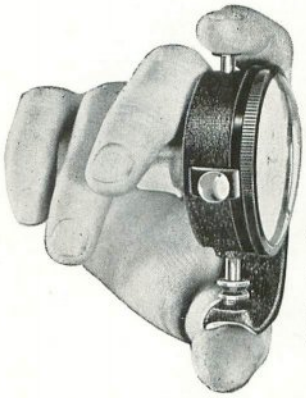
SPECIFICATIONS

Maximum Measuring Depth	
Model 49P	4"
Model 49P-200	8"
Maximum Jaw Opening	
Model 49P	3"
Model 49P-200	3"
Minimum Graduation of Indicator (Specify which you desire)	.010" or 1/64"
Dial, Continuous (Revolution Counter with Double Dial) (Can be rotated)	0–1000
Weight (Approx.)	1¼ lbs.
Furnished in protective case.	

*Note: Model 49P-172, with minimum graduation of .001", a 0-100 dial and a maximum jaw opening of 2" is also available, price on request.

MODELS 26P-7 AND 20P





MODEL 26P-7

Illustration above is actual size.

Note how conveniently the gage is held by the thumb and second finger.

PORTABLE THICKNESS AND SMALL PARTS GAGES

MODEL 26P-7 small, hand size, portable gage is for quickly measuring the thickness of various kinds of sheet material. It is also adaptable for checking small parts produced on screw machines and production lathes. The sensitive contact is normally open and is brought in contact with the workpiece against the reference anvil by finger pressure applied to the button at the top of the gage. For this reason, gage is not recommended for compressible material.

Gage is shaped for natural and convenient grip between thumb and second finger. The forefinger is free to control the sensitive contact. Indicator has a double dial that can be rotated for setting zero. A revolution counter is provided to count off the revolutions of the large hand.

MODEL 20P is a very light pocket thickness gage. It differs from Model 26P-7 in that the contacts are normally closed and finger pressure on the button at top opens them. This arrangement adapts gage for compressible material as well as the other uses. Special anvils and spring pressure can be furnished to meet specific gaging requirements. Indicator dial is stationary.

MODEL 20P

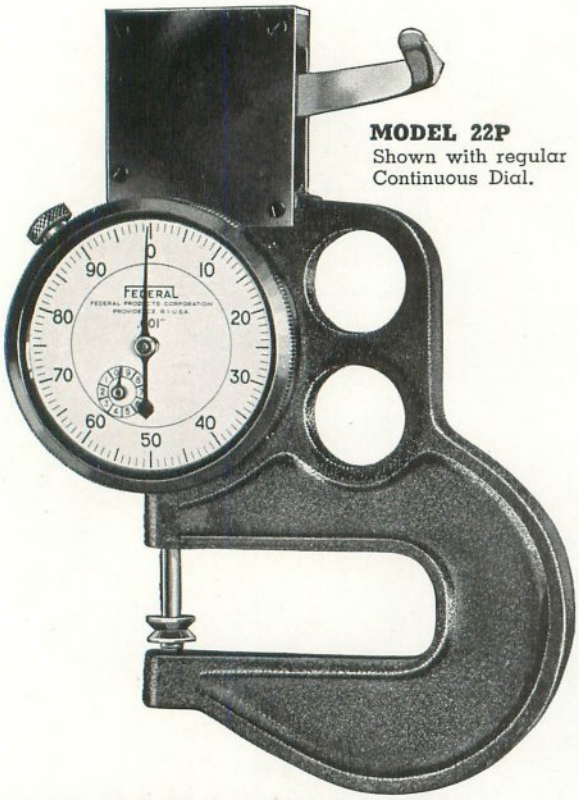
This small flat gage makes a good pocket instrument.

SPECIFICATIONS

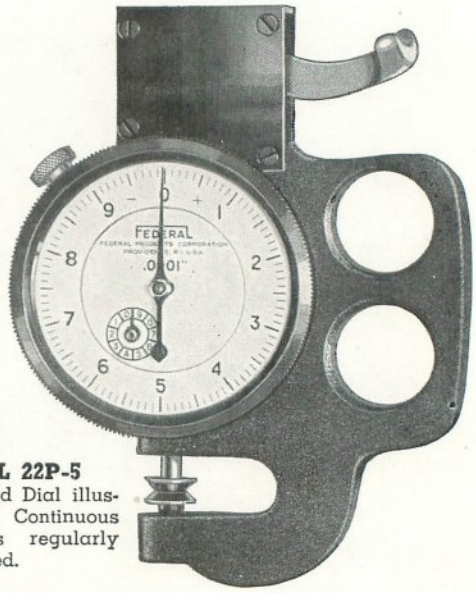
	MODEL 26P-7	MODEL 20P
Indicator Model	C8I	Special
Metric Indicator, Model P6I		
Minimum Graduation	.001"	.001"
Dial, Continuous	0–100	0–100
Maximum Vertical Capacity	.300"	.200"
Maximum Throat Depth	¾"	¾"
Contacts, Reference and Sensitive, diameter	¼"	¼"
Weight, Net (Approx.)	8 oz.	5 oz.

Furnished in protective case.

MODELS 22P AND 22P-5



MODEL 22P
Shown with regular Continuous Dial.



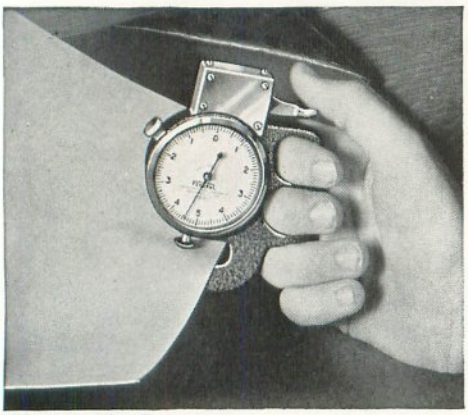
MODEL 22P-5
Balanced Dial illustrated. Continuous Dial is regularly furnished.

Illustrations are two-thirds size.

PORTABLE THICKNESS GAGES

These convenient gages inspect the thickness of sheet material and small parts with great accuracy. Because of their accuracy and their easy handling they are also used as small snap gages. When used for such purposes Balanced Dials are provided on the Indicators. The principal difference between these two gages is in the capacity they will handle and the fineness of their graduations.

The anvils, which are hardened, ground and lapped flat are retracted by the finger-operated lifting lever. Anvil pressure is independent of any influence on the part of the operator. Special sizes and shapes of anvils can be furnished to suit requirements, prices upon request.



MODEL 22P-5
conveniently and quickly inspects the thickness of sheet material

MODEL 22P-5
with special anvils is used to inspect the diameter of small pinions during production.

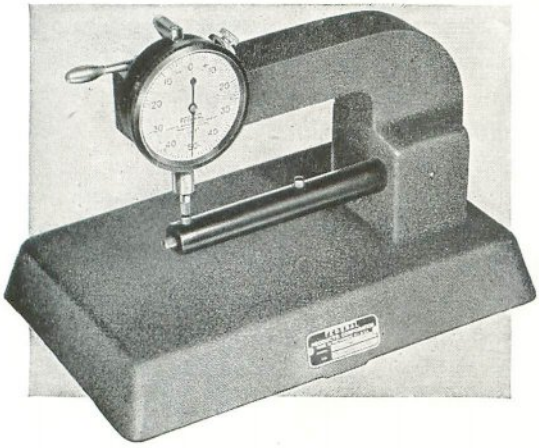
SPECIFICATIONS

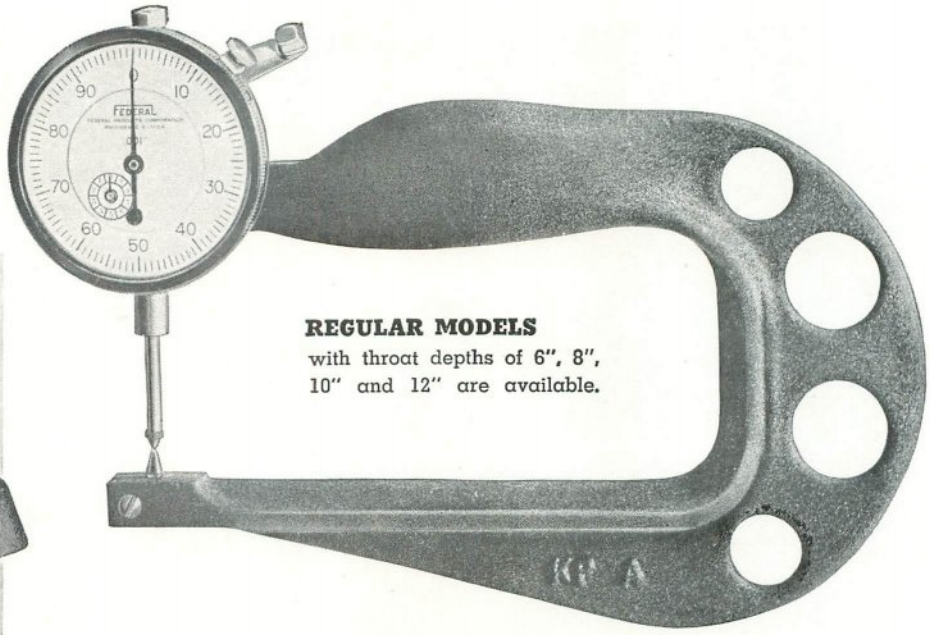
	MODEL 22P	MODEL 22P-5
Indicator Model	C8I	C2I
Metric Indicators	P6I	P1I
Minimum Graduation	.001"	.0001"
Range	.500"	.100"
Dial, Continuous (Revolution Counter with Double Dial) Dial can be rotated. Balanced Dial optional.	0–100	0–10
Maximum Vertical Capacity	.500"	.100"
Maximum Throat Depth	2"	11/16"
Diameter of Reference Anvil and Sensitive Contact	1/4"	1/4"
Weight, Net (Approx.)	10 oz.	7 oz.

Furnished in Protective Case.

MODEL K SERIES

MODEL KB-108
is a bench type gage with a special anvil for inspecting the thickness of tubing.





REGULAR MODELS
with throat depths of 6", 8", 10" and 12" are available.

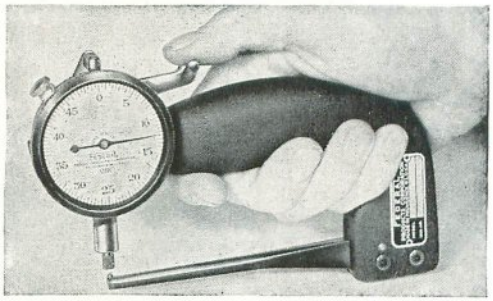
PORTABLE THICKNESS GAGES

The Model K Series is a portable, deep throat, thickness gage or comparator. Its uses are many and varied, such as gaging wall thickness of tubing, castings, and flat stock.

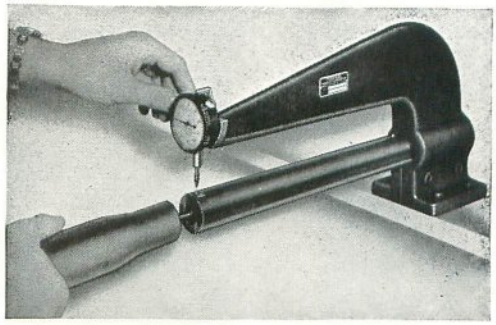
It is equipped with a long range Indicator which makes it possible to gage a wide range of thicknesses and also clear flanges, bosses, etc. The frame is of ribbed construction for lightness and strength with a hand grip located at the proper balance of the gage for easy operation.

The sensitive anvil is retracted by means of a lifting lever conveniently located for easy operation. Contact pressure is independent of the operator. The anvils regularly furnished are tapered and radiused at the point.

This type of gage can be supplied in a wide range of frame sizes and with various Dial Indicator Models. It also can be furnished in bench types as well as portable types, to meet special requirements.



MODEL KP-102
is a smaller type gage made to enter into a small diameter or recess.



MODEL KB-76
is a thickness gage designed for bench mounting and is used for checking wall thickness of tubing, shells, etc.

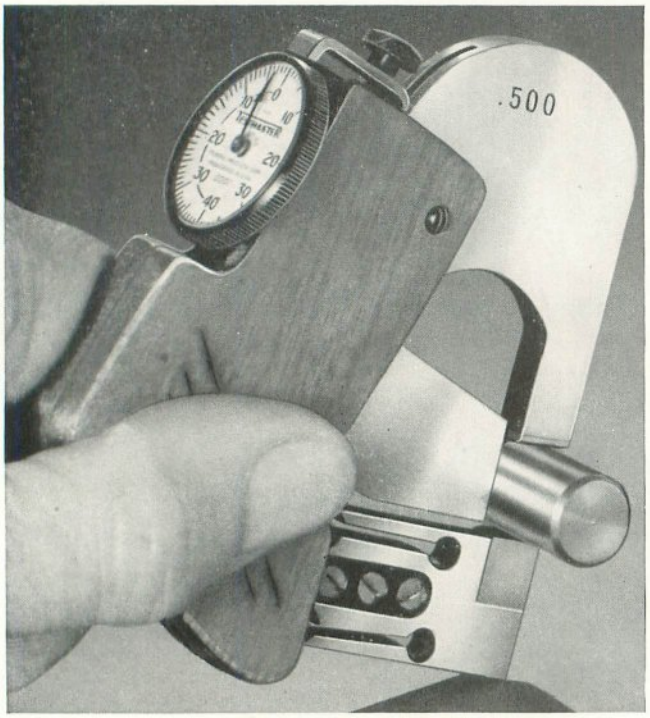
SPECIFICATIONS

Indicator Model	C8IS
Metric Indicator, Model Q6IS	
Minimum Graduation	.001"
Range	1.00"
Dial, Continuous (Revolution Counter with Double Dial)	
(Dial can be rotated)	0–100
Maximum Vertical Capacity	1"

*Maximum Throat Depth	
Model KP-120	6"
Model KP-119	8"
Model KP-125	10"
Model KP-129	12"
Contact Points Reference and Sensitive	
Cone-shaped	Hardened Steel
Weight, Net (Approx.) (KP-120)	1¾ lbs.

*Gages with greater throat depth, but with otherwise the same specifications can be furnished.

MODEL 1340 SNAP GAGE



SINGLE-PURPOSE INDICATING GAGE SHOWS AMOUNT OF VARIATIONS

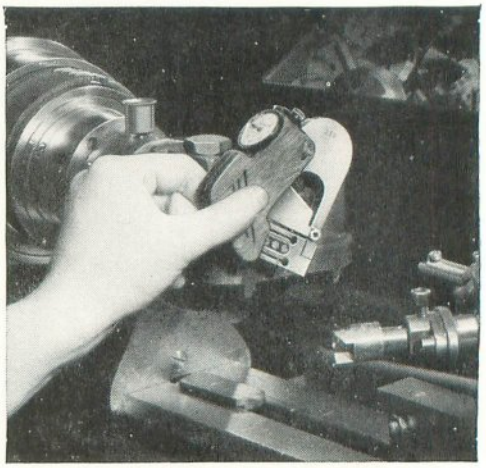
Contrast this Indicating Snap Gage with the conventional fixed-type go, no-go snap gages. The old style fixed gage relies for its accuracy on the person using it, and no two people have equal judgment or sense of touch. Moreover, conventional snap gages only reject or accept the parts. They don't measure. They require frequent inspection themselves, and must be reconditioned or replaced periodically.

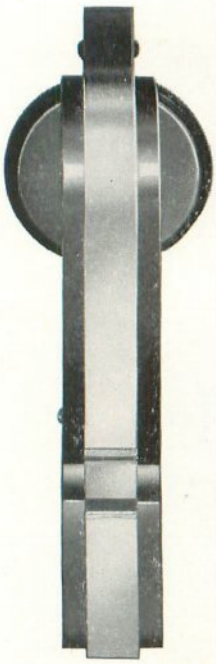
Model 1340 is an extremely simple compact instrument built to show actual dimension variations of .0001" no matter who is doing the gaging. The gage consists of a solid piece of steel which, through an ingeniously simple design, transfers size variations from its sensitive anvil so they can be *read* on the Indicator. Accuracy of measurement is designed into the Gage. Gage wear is readily compensated by adjusting the Indicator Dial.

Model 1340 is made to the nominal dimension specified. The measuring anvils are lapped parallel and are Tungsten Carbide faced to give long wear and to obviate frequent checking to the master. Has insulating finger grip. It is an inexpensive gage and practically fool proof.

It's a Must for Statistical Quality Control.

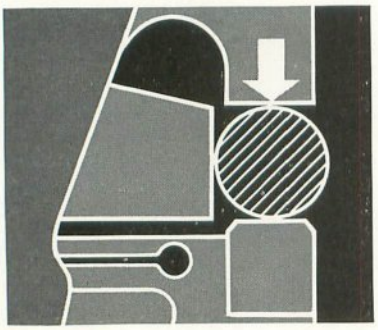
Statistical Dimensional Quality Control depends for its data on instruments such as this. Model 1340 furnishes the actual dimension information used in plotting charts to keep processes "in control" *right at the machine*. It is fast to use, fast to read and totally dependable in each inspection.



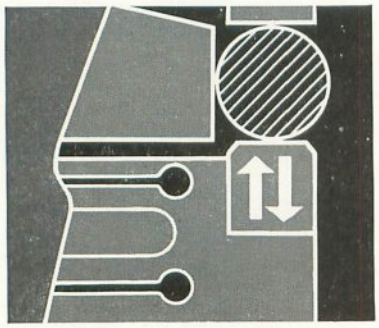


NOTE HOW THIN IT IS.

It will enter between shoulders.



THE READING is not influenced by weight of Gage, nor by user's hand because weight of gage and hand rests upon upper solid anvil.



THE SENSITIVE ANVIL is ingeniously designed to transfer dimensional variation to Indicator. Both anvils are tungsten carbide inserts for long wear and are lapped parallel.

SPECIFICATIONS

Minimum Graduation	.0001"
Dial	0–4–0
Weight — Approx.	7 oz.

Range .008"
Capacity — Made to any single dimension between ⅛" and 1½"

MODEL 200P-1 INDICATING MICROMETER

THE DIAL INDICATOR

on this Micrometer Insures that it will "Repeat" the Same Accurate Reading for Any and All Users

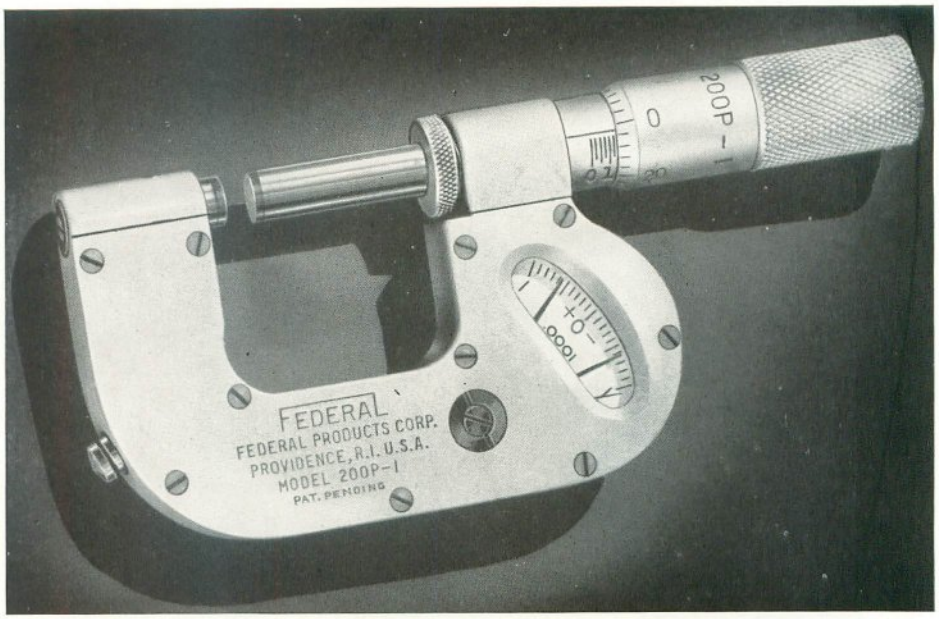


Illustration Actual Size *Patent Pending*

This new Federal Indicating Micrometer combines the precision of the Dial Indicator for uniformity of contact pressure, and for use as a comparator gage, with the accuracy of the micrometer screw for measuring. Both its outstanding practical values and its mechanical advantages are outlined herewith.

¶It eliminates the chance for human error and variations in pressure, common to setting ordinary micrometers. You do not need the skill of a toolmaker to operate it accurately. Lower skilled operators get equally accurate readings.

¶It saves time and argument between foremen and workmen by giving more positive information.

¶The retractable anvil saves wear and prevents scratching of the work. The retracting mechanism cannot influence the reading.

¶It is useful for both individual measurements and as a comparator for comparing duplicate dimensions on short runs of duplicate parts. It is faster to use than an ordinary micrometer.

¶It eliminates the necessity for having a complete set of "go and no-go" gages because you can set it to the required size, clamp it in that position and then gage your batch of parts.

¶It is excellent for conducting Dimensional Quality Control by statistical methods because it furnishes the sub-division readings so essential to this method.

¶The Dial Indicator itself has a six jewel Federal Low-Friction movement. Anvils are both tungsten carbide, lapped parallel.

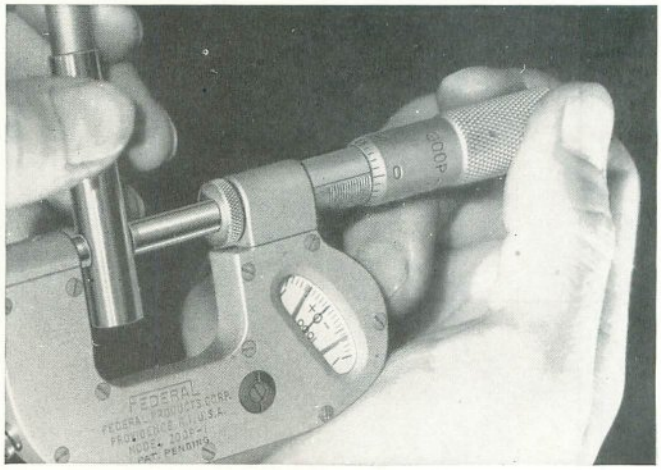
¶The dial graduations are easily read and the tolerance hands can be set to requirements.

¶The clamping screw clamps the spindle in position evenly, not sideways. Thus, it does not tend to throw the spindle setting off as some micrometer spindle clamps do.

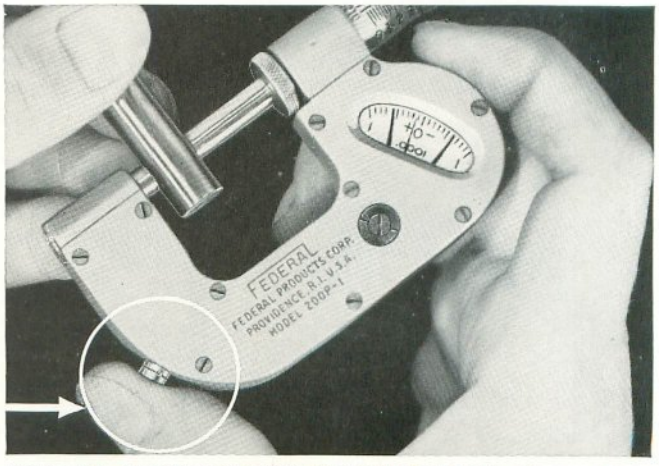
¶It is light and easy to handle. Its shape is only slightly different and only slightly (2 or 3 ozs.) heavier than that of the conventional micrometer.

¶It has a beautiful, dull chrome finish which prevents glare and makes markings stand out. It also prevents rust. This, with the Tungsten Carbide anvils, insures long life.

The above advantages, together with the thorough design, careful precision workmanship, and general high quality, furnish a new and exceptionally useful instrument that is a definite asset in any workman's hands.



USED AS A MICROMETER The spindle is brought into contact with the work. The thimble is adjusted to the nearest thousandth mark and the dial then read to tenths of thousandths (.0001").



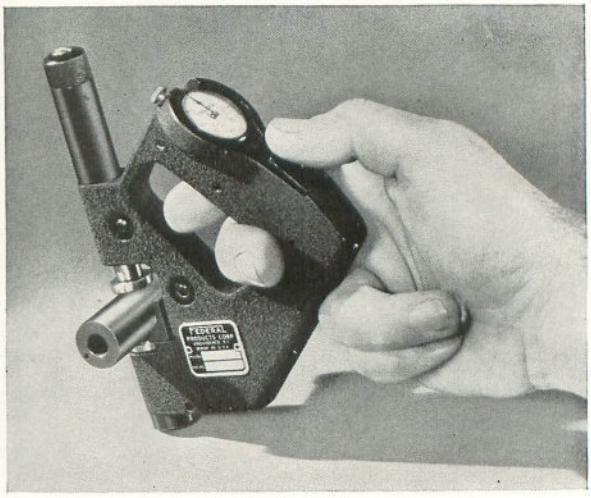
USED AS A DIAL INDICATOR COMPARATOR The spindle is clamped in position and dimensions are then gaged for accuracy. The push button retracts the lower anvil. Tolerance hands are set to required limits.

SPECIFICATIONS

Minimum Graduation	.0001"	Range	.002"
Dial	1–0–1	Capacity	1.000"

Tungsten Carbide Anvils (Lapped parallel). Dial Indicator, six jewel Low-Friction movement. Furnished complete in plastic case.

MODEL 1330P-100 SERIES



RETRACTABLE ANVIL INDICATOR SNAP GAGE

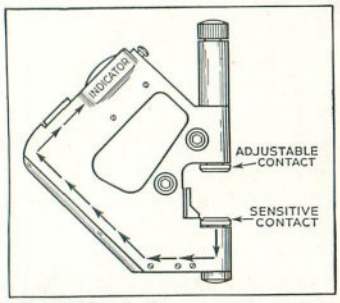
Retractable sensitive lower contact or anvil facilitates application to the workpiece.

Low-Friction transfer of sensitive contact movement to Indicator.

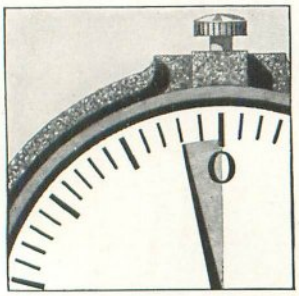
Perfectly balanced and held lightly in your fingers it enables sensitive application to workpiece.

Adjustable upper contact; parallelism of contact faces accurately maintained.

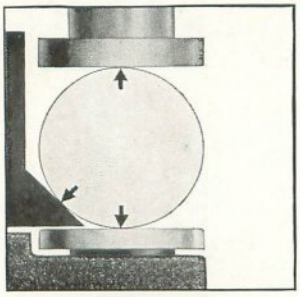
Adjustable backstop.



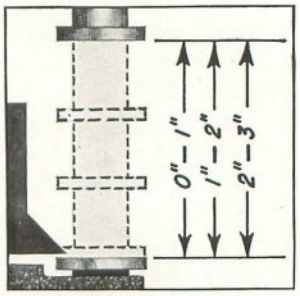
MOTION of the sensitive contact anvil is transferred directly to Indicator through a low-friction, sensitive unit.



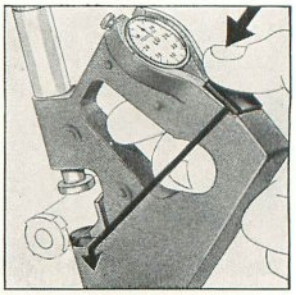
YOU SEE the dimensional variation of the workpiece directly in the Indicator dial. It's a Federal Testmaster Indicator.



ANVILS boron-carbide faced and parallel. Backstop adjustable for various workpiece diameters.



UPPER ANVIL adjustable for diameter. Contact anvil parallelism accurately maintained throughout adjustment range.



LIGHT PRESSURE on thumb button retracts sensitive anvil. Contacts slip over workpiece lightly and easily.

DIAL INDICATOR SNAP GAGES

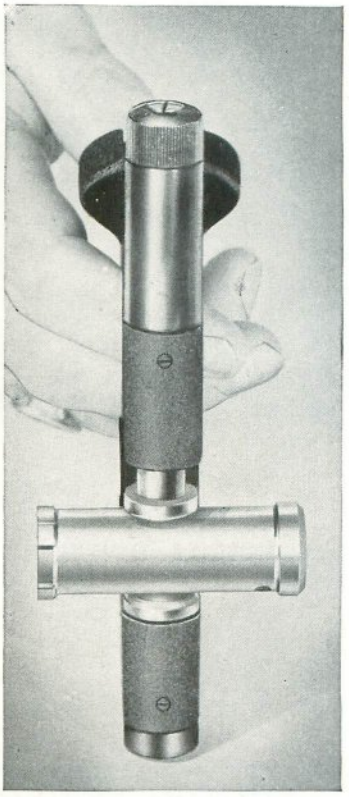
THE MODEL 1330P-100 SERIES GAGES are lightweight gages of the snap gage type for accurate gaging of outside diameters of workpieces; whether at the bench or while they are set up in the machine. You will find them conveniently handled instruments.

The frame is well proportioned and balanced; with a button for retracting the reference anvil, conveniently located for thumb operation. The gage is built at an angle that permits clear reading of the Dial Indicator. The latter is a Federal Testmaster graduated to .0001", which is operated by the sensitive anvil through a frictionless method of motion transfer.

It is easy to apply the gage to the work and it does not mar the finish because the sensitive anvil is retracted by means of a thumb button. The reference contact or anvil is adjustable throughout its one inch range by means of a threaded thimble and can be locked at any setting. The weight of the gage and of your hand rests upon this upper fixed contact. Both contact anvils are faced with boron carbide and are ground and lapped flat and parallel. Parallelism is accurately maintained throughout the adjustment.

The narrow width of the gage permits measurements in recesses or against shoulders not ordinarily accessible with gages of similar types.

A backstop is provided to locate the gage on the part. This backstop is adjustable to any diameter within the one inch range of the instrument.



NOTE HOW THIN IT IS
It gets in between shoulders and other obstructions.

SPECIFICATIONS

Indicator Model . . . . . **Federal Testmaster** (Metric Indicator, Special)
Minimum Graduation . . . . . .0001"
Dial, Balanced (Can be rotated) . . . 0–4–0

Contacts, Sensitive and Reference . . . *Norbide (Boron Carbide) ½" Diam.

*Registered trade mark of Norton Co.

Capacity . . . Model 1330P-100 — 0 to 1.00"
1330P-101 — 1" to 2.00"
1330P-102 — 2" to 3.00"

Weight, Net (Approx.) . . . . . 1 lb.

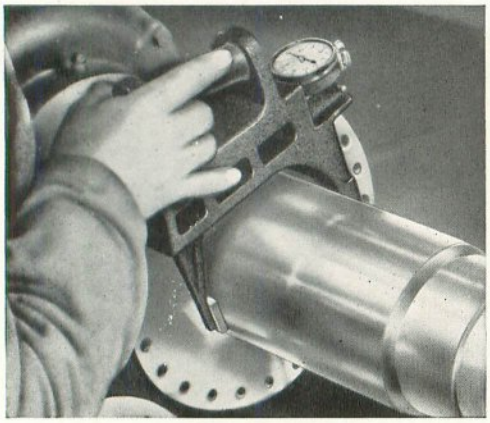
Gage is furnished in a wooden case upon request, at extra cost.

Weight of Gage and operator's hand rests upon the fixed contact. Gage is only ⅝" wide.

Three sizes furnish a total capacity, 0 to 3"

MODEL 1330P-100 **MODEL 1330P-101** **MODEL 1330P-102**

INDICATOR SNAP GAGES



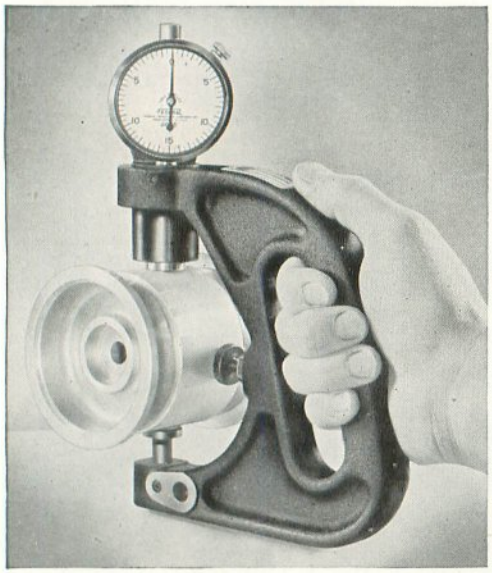
HEAVY DUTY
MODEL 1330 SERIES

Model 1330P Dial Indicator Snap Gages are heavy duty instruments which provide a more positive, faster means of checking outside dimensions than the conventional fixed type snap gages. Through a direct unit, dimensional variations are transmitted from the lower anvil to the Indicator. The gage's weight is supported by the upper or reference anvil. Design and construction insure constant and efficient gaging independent of operator influence.

Both anvils are tungsten carbide faced, and are lapped parallel. Upper is flat, lower is rounded. On adjustable models the variable upper anvil provides the means of gaging a wide range of dimensions. It is recommended that single-purpose types be used for mass-inspection and for larger diameters. Model 1330P is adaptable to special jobs. Send drawings and samples for suggestions. For specifications see below.

Capacity, Diameter (Adjustable Types)

1330P-88	0	to	3⅝"
1330P-78	3½"	to	6⅛"
1330P-79	6"	to	10⅛"
1330P-80	10"	to	14⅛"
1330P-81	14"	to	18⅛"



ROTATING INDICATOR
MODEL 264 SERIES

Model 264P Series is also of rugged construction. It has many potentialities for production and final inspection work, either hand held or as a bench gage (equipped with substantial base—not shown). Unique feature of this gage is its rotating Indicator, a convenience which furnishes full visibility of the Dial in any position. An auxiliary spring behind the sensitive contact gives the right amount of gaging tension to seat the anvils in true alignment with the workpiece. This spring also compensates the weight of the gage and the users hand and in no way reduces the sensitivity and accuracy of the Indicator. Each Model 264 is adjustable for dimensions within its ½" range. Backstop is also adjustable.

Capacity, Diameter

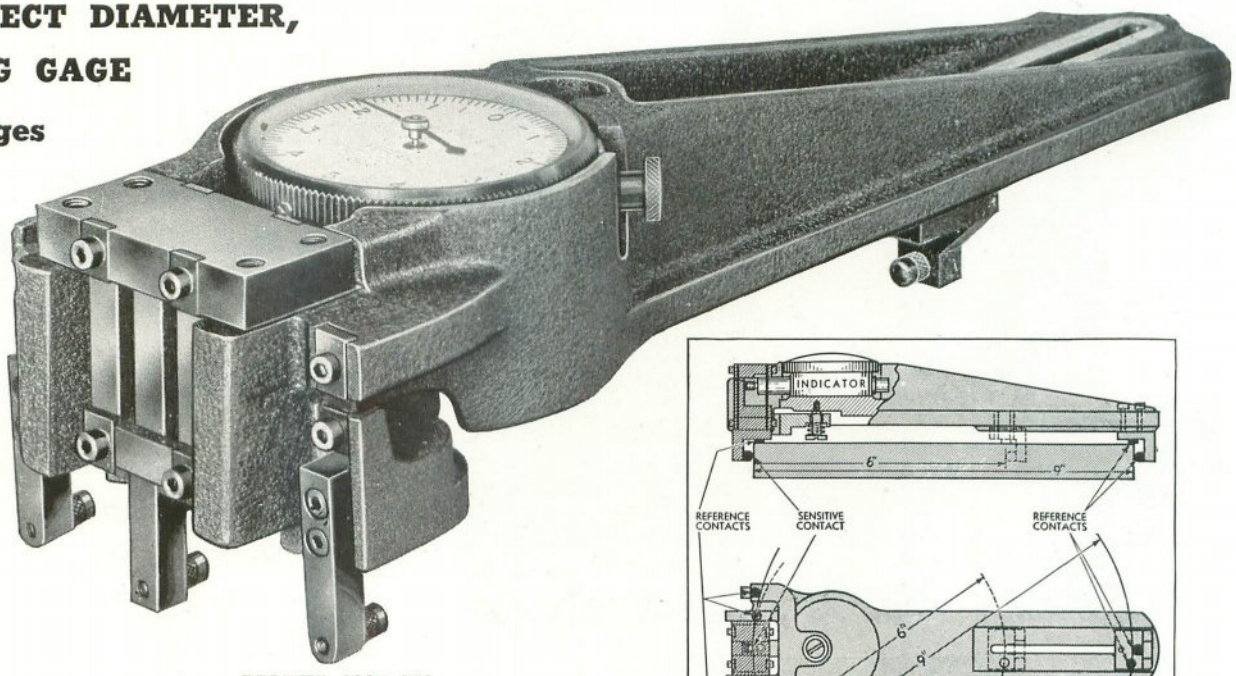
264P-187	0	–	½"
264P-188	½"	–1"	
264P-189	1"	–1½"	
264P-190	1½"	–2"	
264P-191	2"	–2½"	
264P-192	2½"	–3"	
264P-193	3"	–3½"	
264P-194	3½"	–4"	
264P-195	4"	–4½"	
264P-196	4½"	–5"	
264P-197	5"	–5½"	
264P-198	5½"	–6"	
264P-199	6"	–6½"	
264P-200	6½"	–7"	
264P-201	7"	–7½"	
264P-202	7½"	–8"	

SPECIFICATIONS

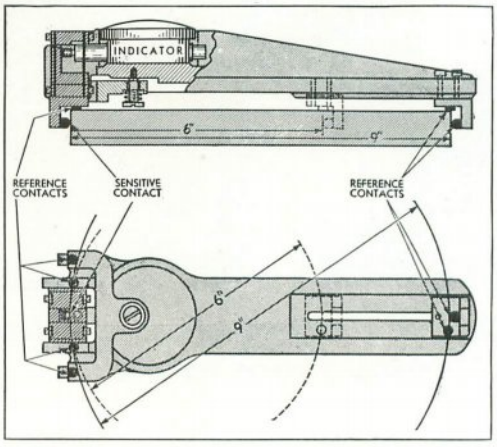
	1330 SERIES	264 SERIES
Indicator Model	C2I	C5M
Metric Indicator	P1I	P6I
Minimum Graduation	.0001"	.0005"
Range	.025"	.075"
Dial, Balanced (can be rotated)	0–5–0	0–15–0
Contacts, Sensitive and Reference	Tungsten Carbide	Hardened Steel
Starting Contact Pressure (approx.)	1½–1¾ lbs.	1¾–2 lbs.
Capacity, adjustable	See Table at top left	See Table at left
Capacity (single-purpose types) Specify diameter to be gaged	2½" and up	

OUTSIDE, DIRECT DIAMETER, CENTRALIZING GAGE

for Large Flanges and Hubs



MODEL 236P-246
(Adjustable. Range 6" to 9")

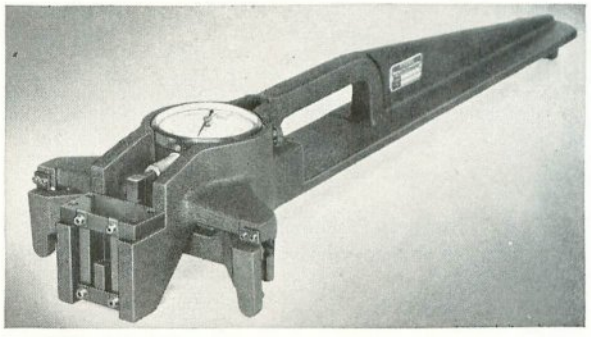


VIEW SHOWS position of sensitive contact, centralizing contacts, and three-point depth positioning contacts.

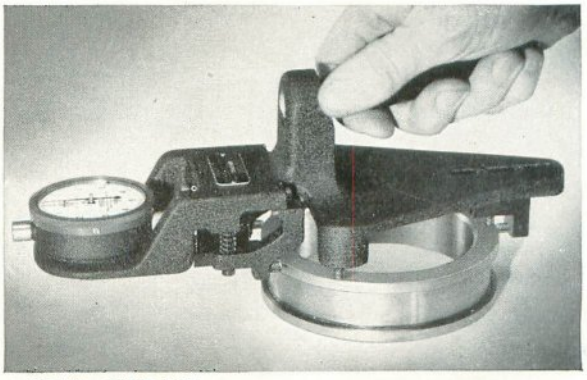
Model 236P Gages are single-purpose gages specially built to your requirements. They will inspect work more accurately and positively than conventional type gages. They check the diameter from the face of the workpiece and can be used in many places that are inaccessible to regular snap type indicating gages.

The gage locates itself on three points, positively against the face of the flange or hub, at the desired depth. These points also locate the gaging contacts perpendicular to the axis of the part being checked. Two other centralizing points mounted on a frictionless suspended centering unit locate the gaging contacts diametrically across the center of the part.

The sensitive contact point transfers its movement directly to the Indicator by a frictionless unit, without any loss of motion. There is no chance for wear in this unit and it also protects the Indicator from side thrusts and shock which would otherwise influence the accuracy of the inspection and possibly damage the Indicator.



MODEL 236P-237
This model is non-adjustable, being designed for single-purpose gaging of larger work.



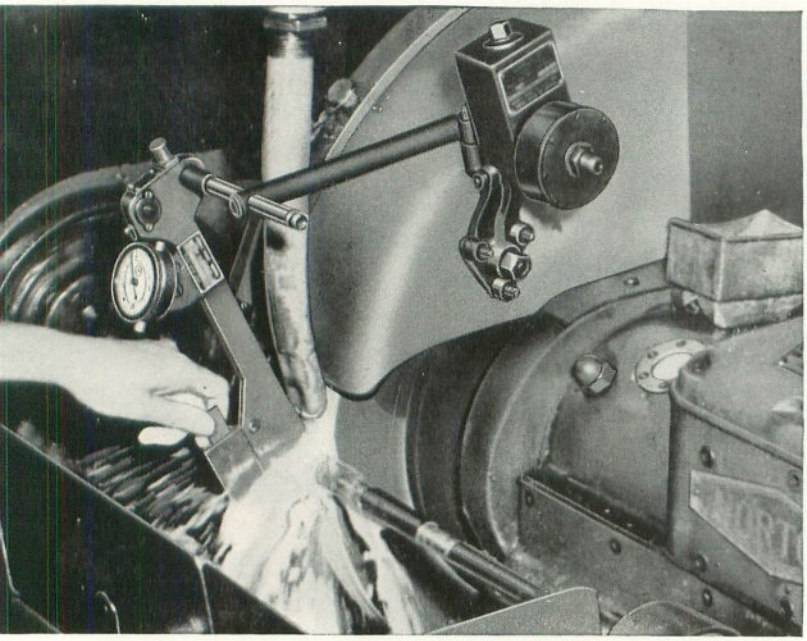
MODEL 236P-117
Gage is easily applied to workpiece. It can also be applied while workpiece is in the machine.

SPECIFICATIONS

These gages are made special for each individual application. For complete specifications send detailed information pertaining to the part to be gaged including blueprints and sample part.

Indicator Model	C2I
Metric Indicator, Model P1I	
Minimum Graduation	.0001"
Range	.025"
Dial, Balanced (Can be rotated)	0–5–0

ARNOLD CONTINUOUS GRINDING GAGES



FOR CONTINUOUS PRECISION-MEASUREMENT OF DIMENSIONS while Grinding Cylindrical Work

Arnold Gages provide an efficient and accurate method of continuously inspecting dimensions on cylindrical work while grinding, whether using traverse or plunge-cut method. Outside diameters, inside or outside widths between faces of shoulders, diameters of narrow shoulders and flanges, tapered diameters and work having splines or keyways — all can be accurately measured with one of the Arnold Gages equipped with the proper accessory. Easily and quickly installed on practically any make or model of external cylindrical grinder, their operation is fast and effortless — and requires no unusual skill or training of the operator.

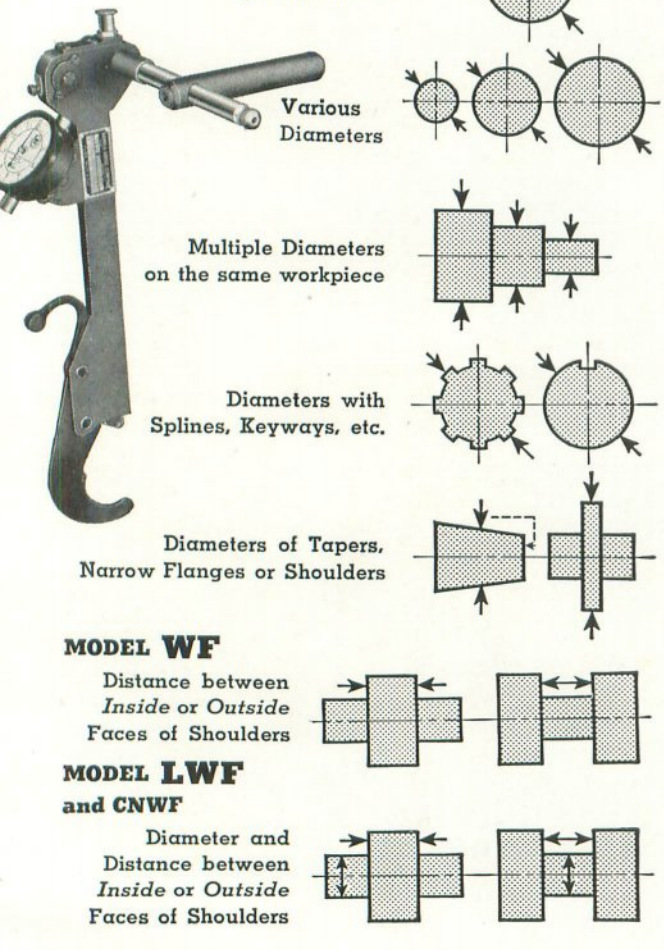
The Arnold Gage is independent of the sizing controls of the machine, so it does not matter if these controls are inaccurate. The Gage is put on the work while it is rotating; and there is no stopping the machine during grinding to "mike" for size. Once the Gage is on the work, all the operator has to do is to watch the Dial Indicator until the piece is ground to size—and when the Indicator says the work is to size, *it is to size*. Oversize regrinds and undersize rejects are practically eliminated.

Space in this catalog cannot begin to show all the possibilities of these very practical gages.

Write for 12-page Arnold Gage folder describing the different types and their applications in detail.

By arrangement with the Arnold Gage Company, whose Gages are equipped with Federal Indicators, we have the exclusive sales rights for all types of Arnold Grinding Gages in the United States and its Territories, Mexico, Central America, West Indies, South America, Russia, Australia, Africa and Asia (except Japan).

They Precision-Measure the following types of work:


MODEL L and CN
Single Diameters
Various Diameters
Multiple Diameters on the same workpiece
Diameters with Splines, Keyways, etc.
Diameters of Tapers, Narrow Flanges or Shoulders
MODEL WF
Distance between Inside or Outside Faces of Shoulders
MODEL LWF and CNWF
Diameter and Distance between Inside or Outside Faces of Shoulders

MODEL L ARNOLD GAGE

The Model L Arnold Gage can be furnished with either a single diameter (single-purpose) caliper (as shown here) or with an adjustable caliper (not shown). Single-purpose calipers are best for long production runs requiring positive control of one particular size. Single-purpose calipers can be quickly interchanged for different sizes. These instruments are often used in batteries of sizes for gaging different diameters progressively at one loading of the grinder. For shorter production runs the Adjustable type calipers cover in one unit a wide range of size control operations.

The Hydraulic Mount and overall balance of the Gage hold it snug against the work on both plunge and traverse cut. Design, materials, finish and general construction of the frame, contacts, caliper points and Indicator are such that the Arnold Grinding Gage will stand up under "machine shop" treatment and give very sensitive and repetitive indications with only periodic adjustment. The Nitroloy plunger is closely fitted in the frame. Any sensitive contact motion is accurately relayed to the Indicator. Excess shock cannot injure the Indicator, due to the design of the Arnold Gage. Fine setting of the Indicator enables the operator to set Zero at the top of the dial for each job.

Each Gage adds great speed to grinding operations. Majority of users of Arnold Gages work to tolerances of plus or minus .0001". This type of precision work can be done fast, consistently and with an absolute minimum of scrapped work.

HYDRAULIC MOUNT

This device automatically lifts the gage up out of the way when not in use. Tension and speed of lifting arm can be adjusted to suit requirements. Fastens to grinding wheel guard of practically any type.

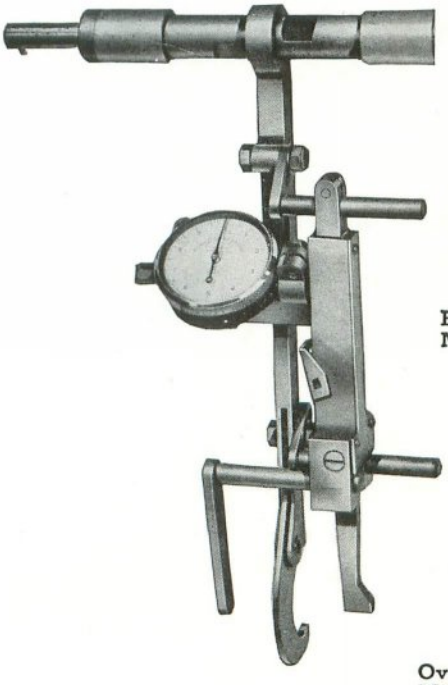
CALIPER

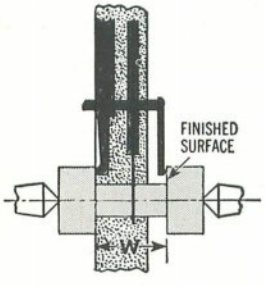
Section indicated by bracket is Caliper. It is interchangeable for different work sizes. Adjustable Calipers can also be furnished.

Note — All contact points are Tungsten Carbide. They are practically wear-proof.

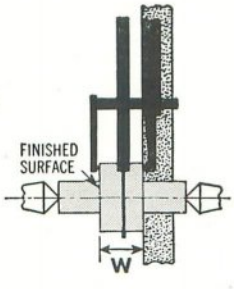
MODEL WF

This Gage is designed for precision control of grinding lateral widths between or over shoulders. *It does not measure diameter.* Gage components are readily arranged to control outside or inside widths and may often employ the arbor, chuck or machine itself for a reference contact.





Between-shoulders (Inside) Measurement of Width.

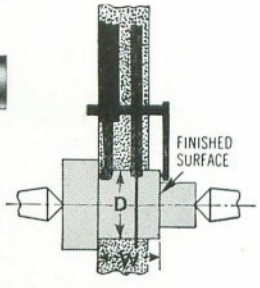


Over-shoulders (Outside) Measurement of Width.

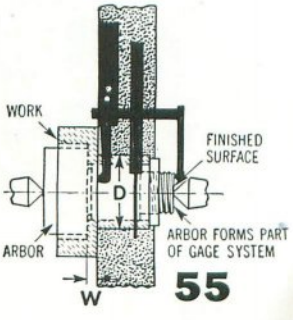
MODEL LWF

This is a combination diameter (L) and width (WF) gage for controlling both diameter and width simultaneously. On many grinding operations, cylindrical and face grinding can be performed at one pass of the wheel. Model LWF is an ideal gage for maintaining consistent dimensional control of this sort of work in process.

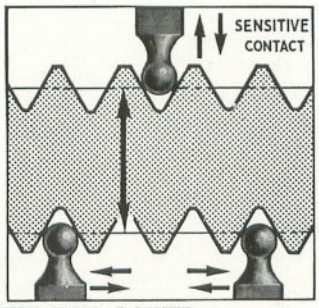
For more complete information and specifications write for special 12-page folder.



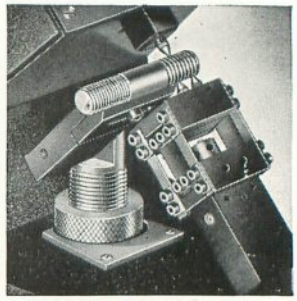
Combination Measurement of Diameter and Shoulder-width on Multi-stepped Part.



MODEL 45 SERIES (Ball Contact)



THE TWO LOWER points float laterally to adjust themselves to the lead.



COVER PLATE removed to show independent mounting of the two lower points on backstop.

THREE POINT (Compensating) PITCH DIAMETER GAGE

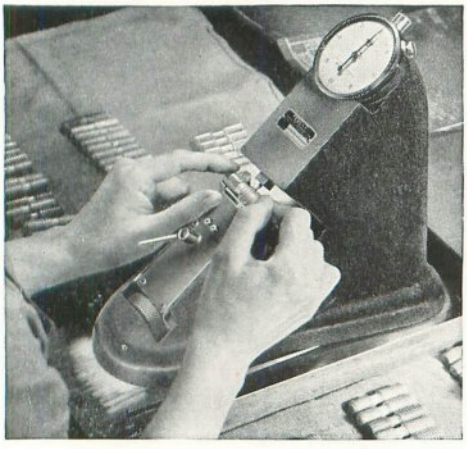
This Model 45 furnishes a new method for inspecting the Pitch Diameter of threads on the same principle as Three Wire method, but with the greater speed and accuracy of the Dial Indicator. It is highly recommended for high quality finish threads, such as ground threads, but not for cut or chased threads.

Two ball-shaped lower reference contacts or anvils are mounted so that they are free to float laterally and independently of each other and so seat themselves between the faces of any two threads. Because of their independent lateral motion they automatically adjust themselves independently of any inaccuracies in the lead of the threads.

The upper sensitive contact locates between the adjacent thread faces on the pitch diameter and measures the diameter variation. See illustration above. This contact is very sensitive as it is suspended on reeds. The Indicator follows its movement uninfluenced by side thrusts and independent of all friction or lost motion.

The backstop is adjustable vertically, laterally and angularly. It can be set accurately to support the work, and can also be positioned to permit clearance for the heads of studs or larger diameters on the same part. The lower reference anvil unit is also precisely adjustable for diameter.

The ball contacts are interchangeable for different pitches and are marked for size. The gage is set to a master, hence any small amount of wear on the contacts will not affect the readings. Any major wear is compensated for by rotating the points slightly.



ACCURACY with speed and visibility are outstanding characteristics.

SPECIFICATIONS

Indicator Model D2I
Metric Indicator, Model Q1I

Minimum Graduation . . . . . .0001"
Dial 0–5–0

Contacts, Reference and Sensitive Tungsten Carbide Ball Points (Diamond Points can be furnished on request)

BALL POINT CONTACTS—either Tungsten Carbide or Diamond are *not* furnished with the gage but are supplied *as extra* for the size specified. Thread or range of threads for each set of Ball Points for American National Form Thread is as follows:

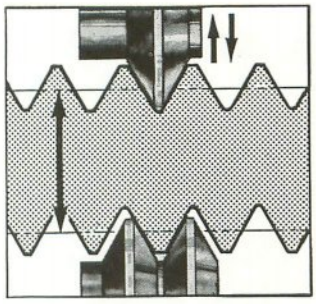
POINT SYMBOL	Threads Per Inch	POINT SYMBOL	Threads Per Inch
A	4	I	12 and 13
B	4½	J	14 through 16
C	5	K	18 through 20
D	6	L	22 through 26
E	7	M	27 through 32
F	8	N	36 through 48
G	9	O	50 through 64
H	10 & 11	P	64 through 80

Special Ball Point Contacts can be furnished. Prices on request.

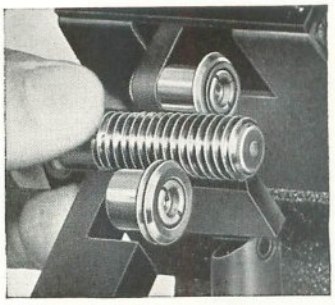
GAGE MODEL	Capacity	Base Dimensions	Height	Weight
45B-80	1/16" to 1"	6½" x 12½"	11"	30 lbs.
45B-90	1" to 2⅛"	6½" x 12½"	11"	30 lbs.
45B-130	1/16" to 2⅛"	6½" x 12½"	11"	30 lbs.

Furnished with protecting cover.

(Roller Contact) MODEL 45 SERIES



LEAD ERRORS do not affect the pitch diameter readings, because the contact engages only one thread.



THE GAGE is easily set to check any diameter within its range. The sizes available are listed below.

ROLLER THREAD PITCH DIAMETER GAGE

This Model 45 Gage inspects the Pitch Diameter of threaded parts by means of roller contacts or anvils. Only one thread is contacted, thus eliminating the effect of possible lead errors in the pitch diameter reading. Because of this, these gages combine the better characteristics of the roller snap gage with the speed, positiveness and greater accuracy of the Dial Indicator Gage.

The upper roller anvil is the sensitive contact and is mounted on a frictionless unit which transfers any size variation to the Indicator. The roller has a single annular rib ground to fit between two adjacent threads contacting the side of each, as shown in the illustration. The lower or reference roller anvil has a double annular rib ground to contact on either side of the thread. It is adjustable and can be set to receive work of any diameter within the capacity of the gage.

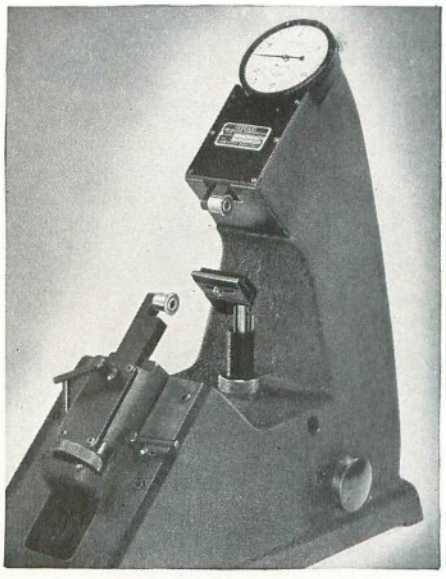
The anvils are free to rotate, which helps to distribute wear equally. They are free to slide laterally to permit accurate positioning on the thread and can be easily and quickly changed for checking different pitches. The ribs on these anvils are located at the end of the rolls enabling inspection to be made close to a shoulder. Each set of roller anvils will cover several pitch diameters as shown below.

The backstop positions the threaded section between the roller anvils. It is adjustable for all sizes within the capacity of the gage. It also has a slight angular adjustment to permit accurate setting against the part, and a lateral adjustment to accommodate parts with a shoulder.

MODEL 45B (Below)

A simple inexpensive gage with a pointed sensitive contact and a "V" shaped lower anvil. Indicator Model D5M, graduated .0005", Range .075", Max. cap. 2".

PITCH RANGES 4½–7, 8–13, 14–20, 22–30, 32–40.



GAGES for large pitch diameters are proportionately rigid.

SPECIFICATIONS

Indicator Model D5M
Metric Indicator, Model Q6I
Minimum Graduation . . . . . .0005"
Dial, Balanced (Can be rotated) 0–15–0
Contacts, Sensitive and Reference . . . . . Roller Anvils
(American National Form Thread)

ROLLER ANVILS are *not* furnished with the gage but are supplied *as extra* for the size specified. Range of pitches for each set of roller anvils is as follows:

4½ – 6	11 – 13	22 – 30	44 – 56
7 – 10	14 – 20	32 – 40	64 – 80

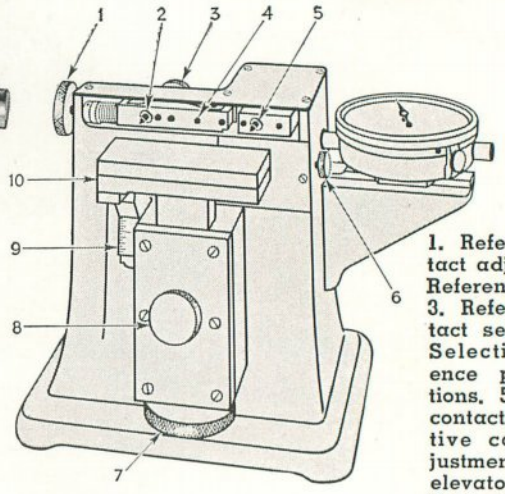
Special thread rolls can be furnished. Prices on request.

MODEL	Capacity	Base Dimensions	Height	Weight (approx.)
45B-100	⅛" to 1"	6½" x 12½"	11"	30 lbs.
45B-110	1" to 2⅛"	6½" x 12½"	11"	30 lbs.
45B-120	⅛" to 2⅛"	6½" x 12½"	11"	30 lbs.
45B-125	2" to 4"	7 " x 13¾"	14"	45 lbs.

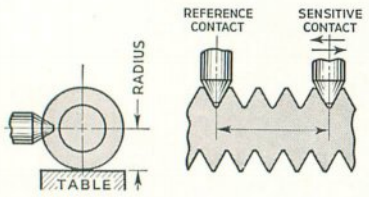
Furnished with protecting cover.

MODEL 1141

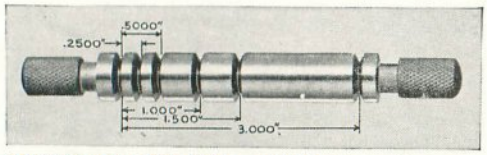
The Really Accurate Way to Inspect Lead



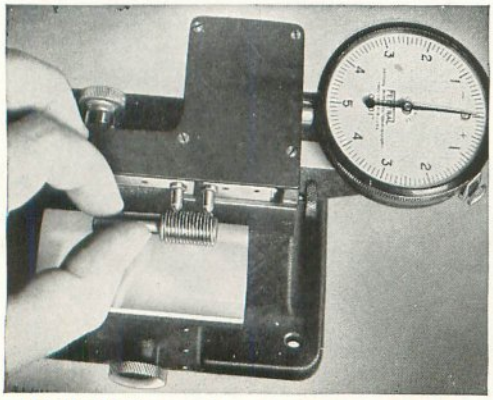
1. Reference contact adjustment. 2. Reference contact. 3. Reference contact set screw. 4. Selective reference point locations. 5. Sensitive contact. 6. Sensitive contact adjustment. 7. Table elevator screw. 8. Table set screw. 9. Elevation scale. 10. Table.



LEAD ACCURACY is immediately determined positively and definitely. Inaccuracies are *not* averaged as with multiple rollers.



MASTER No. MR-1154 available for setting contacts.



ACCURACY, speed, and positive inspection will protect the precision of your thread leads.

THREAD LEAD GAGE

Model 1141 Gage inspects the lead of screw threads of studs, thread plugs, taps, and the spacing of holes, grooves, notches, etc. It is a fast, accurate means of comparison. It's a very sensitive, accurate instrument because the movement of the contact is transferred directly to the Dial Indicator through a frictionless unit.

Various settings for length are obtained by inserting the contacts in the proper holes, final setting being taken care of by adjusting the reference contact support.

Both sensitive and reference contacts are tapered points and contact the threads definitely and centrally in line with the axis of the thread. Contacts are hardened and accurately ground to the proper angle for location in the threads. Clearance is provided for the root of the thread. This clearance is governed by the pitch of the thread to be checked, therefore *thread sizes should be specified when ordering.*

The ground table for supporting the workpiece is adjustable vertically for various diameters, and then fastened at the desired position. A scale mounted on the upright portion of the base and a pointer attached to the table support provide a means of setting for diameters.

A master, No. MR-1154, for various reference settings can be supplied but is not included with gage.

SPECIFICATIONS

Indicator Model D2I
Metric Indicator, Model Q1I

Minimum Graduation . . . . . .0001"
Dial, Balanced (Can be rotated) 0–5–0

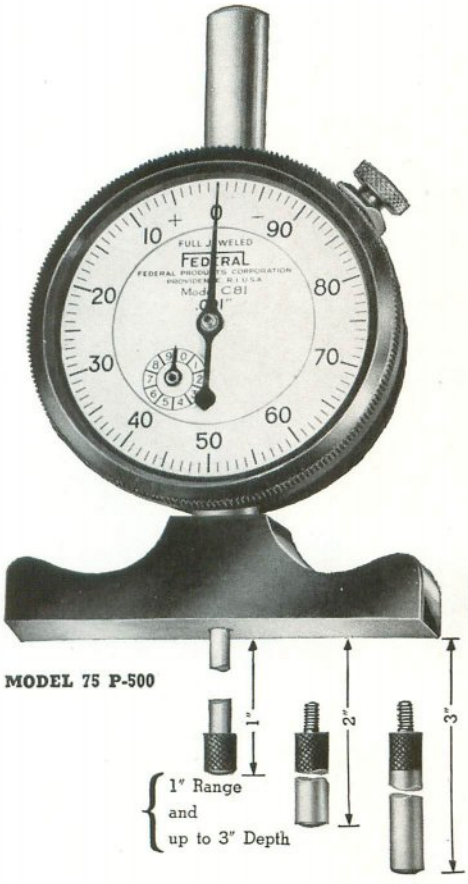
Contacts, Sensitive and Reference . . . . . Hardened and ground
One set of contacts furnished with each gage. Range of pitches for each set of contacts is as follows:

4½ to 7, 8 to 13, 14 to 20, 22 to 40
Contacts are regularly furnished ground to a 60° "V" point and have a slight flat ground on them to provide root clearance for the threads specified. If thread sizes are not specified, contacts are furnished with contacts ground to a point which is ground flat by the customer.

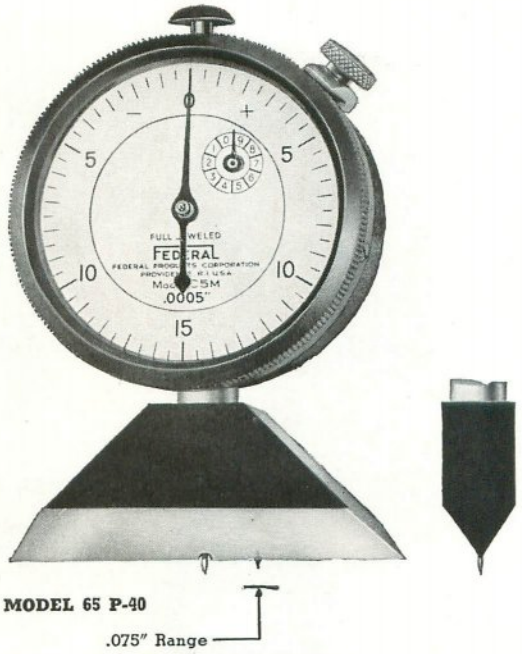
Capacity
Maximum Diameter Screw . . 1½"
Minimum Diameter Screw (4–40 Thread) . . . . . .112"
Maximum Distance between Points . . . . . 2⅝"
Minimum Distance between Points . . . . . ¼"

Special No. 1161 Attachment enables minimum distance between points of .156" to be obtained. Furnished extra.
Master No. MR-1154 for setting Gage. Furnished extra.
Table Size . . . . . 2" x 1¼"
Weight, Net (Approx.) . . . 14½ lbs.
Size, Overall (Approx.) 9" x 5½" x 6"
Furnished with protecting cover.

MODELS 65P AND 75P



Additional points available to increase capacity to 1". Longer lengths special.



DEPTH GAGES (Dial Indicator Flush-Pin)

These Depth Gages provide a more positive, more accurate and more convenient means of inspecting depths of holes, slots and other recesses than by old style conventional flush-pin types.

SPECIFICATIONS

Bases and Sensitive Contact Points are regularly furnished as specified below. Special bases and points can be furnished at special prices.

MODEL 75 P-500 Long Range, Self-Adjusting Point

For general inspection of various depths.

Indicator Model Metric Indicator Q6IS	C8IS
Minimum Graduation	.001"
Dial, Continuous (Revolution Counter with Double Dial)	0–100
Range, Indicator	.0" to 1.00"
Total Depth Capacity	3.00"

Contact Points, Three furnished 3/16" Diam. 3/16" radius (Pt. No. 225), 1/8" long (Pt. No. 305), 1 1/8" long (Pt. No. 243), 2 1/8" long are included to provide 3" capacity

Base, Flat 2 1/2" x 5/16" (Special bases furnished at extra cost)

Furnished in wooden case.

MODEL 75 P-300 Single-Purpose, Self-Adjusting Point

A single-purpose Gage of limited Indicator range, but of any required depth measuring capacity. Especially suited to production inspection.

Indicator Model Metric Indicators P6I	C5M
Minimum Graduation	.0005"
Dial, Balanced (Revolution Counter with Double Dial)	0–15–0
Range, Indicator	.0" to .150"

Total Depth Capacity. Any single depth between 0" and 1.00". One regular contact point of desired length, in any multiple of 1/8" up to 1", furnished with Gage. Specify length wanted. Additional regular points available in 1/8" steps up to 1". Price 25c each. Longer or intermediate lengths special.

Point, 3/16" Diam. 3/16" Radius

Base, Flat, 2 1/2" x 5/16" (Special bases furnished at extra cost)

Furnished in protective case.

MODEL 65 P-40 Push-Down Point

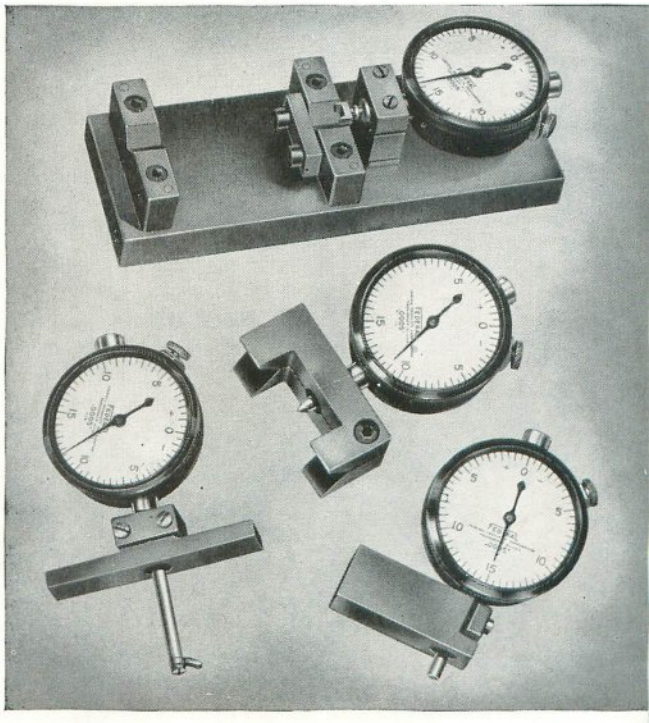
For small recesses, engravings, etc.

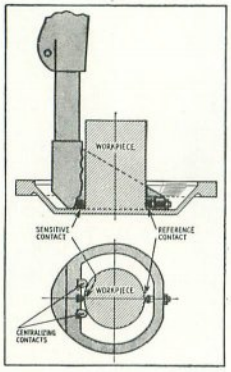
Indicator Model Metric Indicators P6I	C5M
Minimum Graduation	.0005"
Dial, Balanced (Revolution Counter, with Double Dial)	0–15–0
Range, Indicator	.0" to .075"
Total Depth Capacity	.075"
Point V-shaped needle point Max. Dia. (Other points special)	.050"
Base, Knife edge	2 1/2" long

(Special bases furnished at extra cost)

Furnished in protective case.

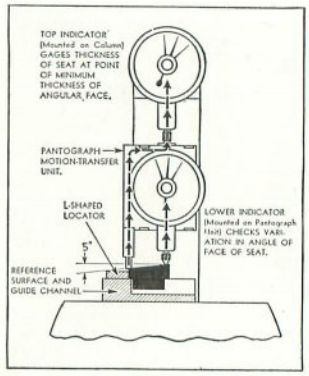
A few of many types of special Depth Gages which increase speed and accuracy of inspection.





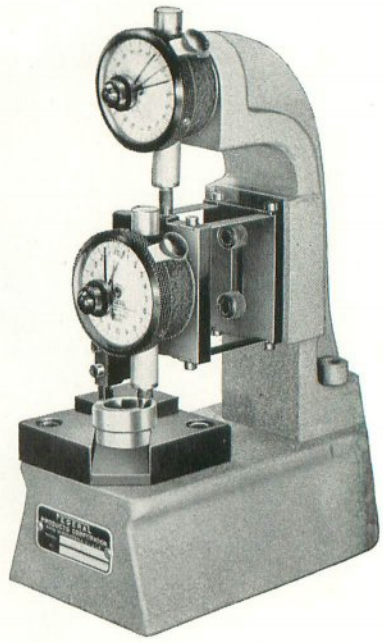
MODEL 236 P-242

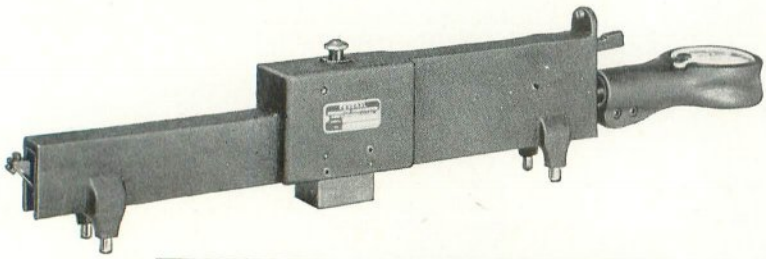
Particularly designed for inspection of Outside Diameters not easily gaged with Bench Type Gages or Comparators. Portable, fast and accurate.

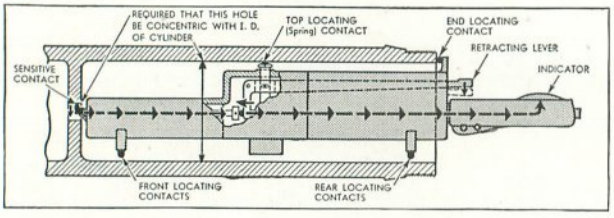

TOP INDICATOR (Mounted on Column) GAGES THICKNESS OF SEAT AT POINT OF MINIMUM THICKNESS OF ANGULAR FACE.
PANTOGRAPH MOTION-TRANSFER UNIT.
L-SHAPED LOCATOR
LOWER INDICATOR (Mounted on Pantograph Unit) CHECKS VARIATION IN ANGLE OF FACE OF SEAT.
5°
REFERENCE SURFACE AND GUIDE CHANNEL

MODEL 247 B-113

Differential Thickness Gage simultaneously checks Minimum Thickness and Angle of Face of Gate Valve Seats. Operation is simple and fast.

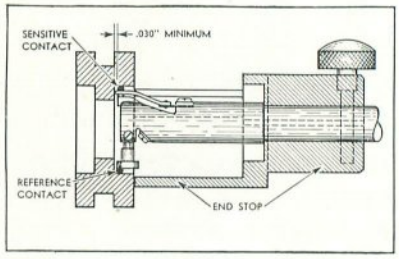


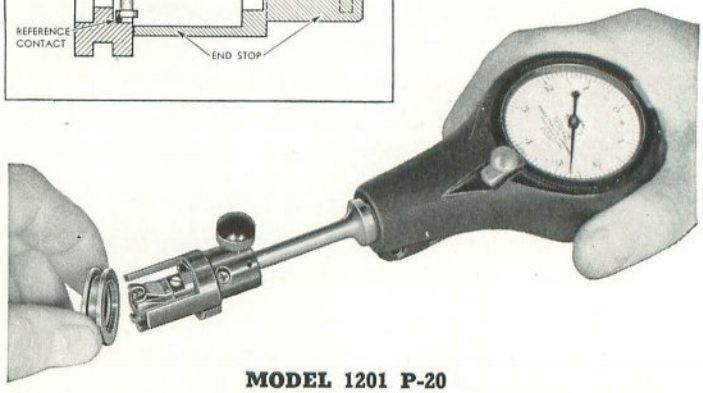




MODEL 205 P-265

Portable Concentricity Gage checks Concentricity of small hole in mid-wall with Inside Diameter of Cylinder (piston or similar work). Has six locating contacts which assure correct positioning of gage in workpiece.

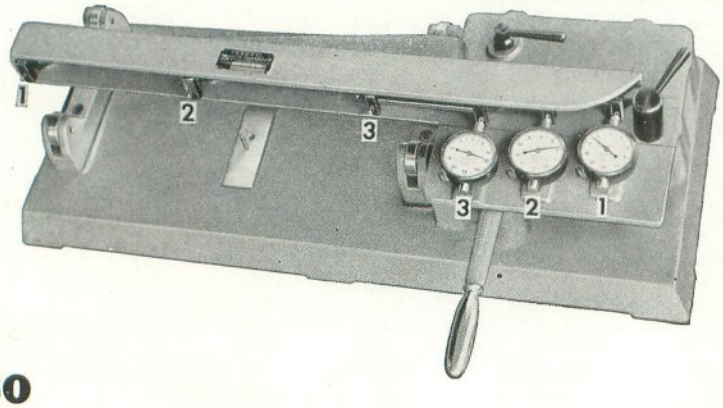


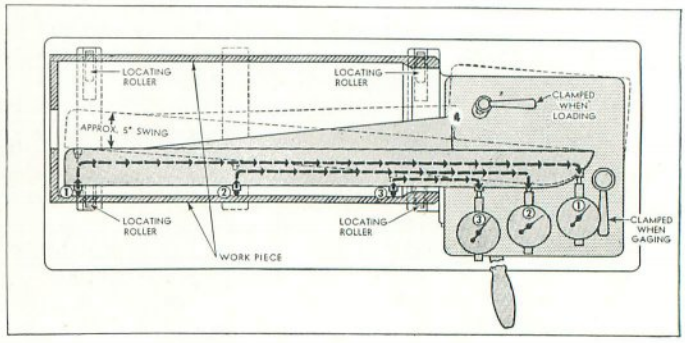


MODEL 1201 P-20

Blind Hole Gage (for I.D.'s from .500" to .750") equipped with Adjustable End Stop which locates gaging contacts perpendicular to axis of hole at predetermined depth in hole.

MODEL 205 B-271 Gage has 3 sensitive contacts in swiveled gaging arm. Checks Concentricity of I.D. with O.D. on cylindrical work having blind ends and constricted openings. Ideal for inspecting housings, bodies, drums, plungers, projectile elements, pistons, etc.





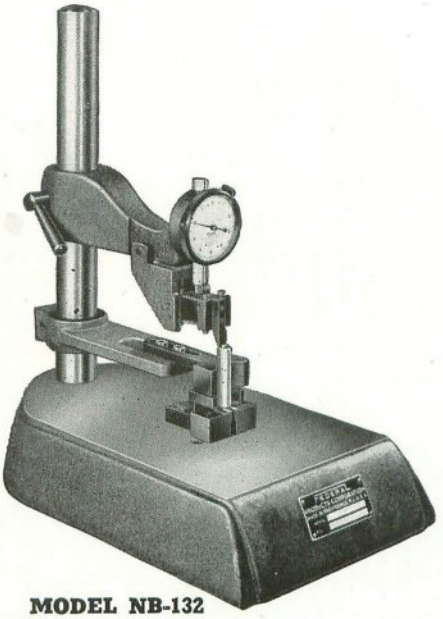
SALES ENGINEERING SERVICE

THE MORE definitely a Precision Measuring Instrument fits the requirements the more precisely it will gage the workpiece. Although Federal offers an unusually wide selection of Regular-Type Catalog Gages, it also designs and builds thousands of Special Gages ranging from fairly simple one-dimension types to complex Multiple-Inspection Gages requiring special design throughout. Many of the Catalog Gages illustrated in the preceding pages are frequently modified to suit individual requirements.

Naturally, an experience obtained from observations of thousands of requirements and applications should be of exceptional value in helping you with your gaging requirements. There are thousands of designs in our files from which to obtain a solution to your needs or from which to obtain suggestions of a better way to gage your work.

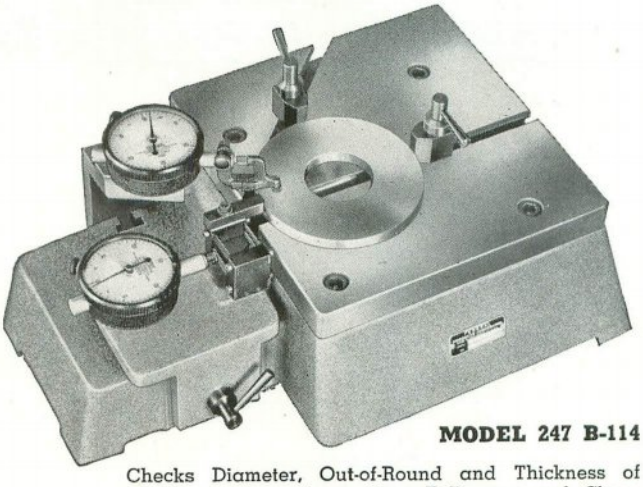
FEDERAL GAGES are being used to measure or compare the dimensions of an untold variety of objects and conditions. From measuring the nerve reflex movement of a frog's leg, the stretch of mammoth cables or the effect of certain methods of cultivation on the growth and size of fruit and vegetables, to the economical, speedy and convenient inspection of millions of interchangeable mechanical parts, Federal Instruments offer practical and efficient solutions to Precision Measuring requirements.

WE INVITE YOU to avail yourselves of the cooperation and services of our Sales Engineering Department. Our Special Design Division may have the solution to your gaging problem right in its files, or can suggest practical methods of handling your work.



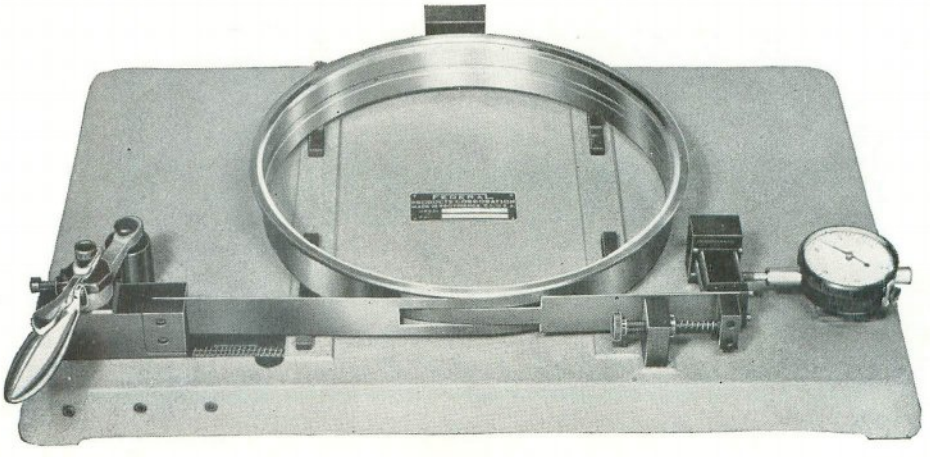
MODEL NB-132

An adaptation of our regular Model NB-60 Comparator, designed for checking the Length of various sizes of Roller Bearing Rolls.



MODEL 247 B-114

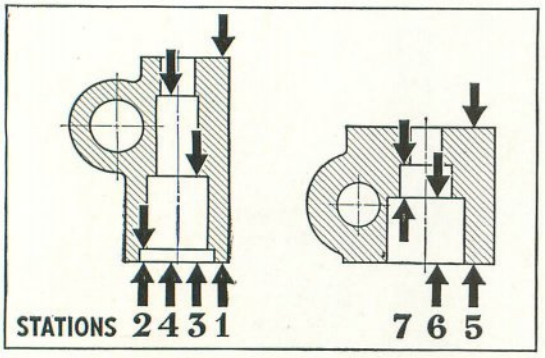
Checks Diameter, Out-of-Round and Thickness of circular parts such as Cam Followers and Close-limit Thrust Washers varying in diameter from 1" to 6", and in thickness from 0 to ¾".



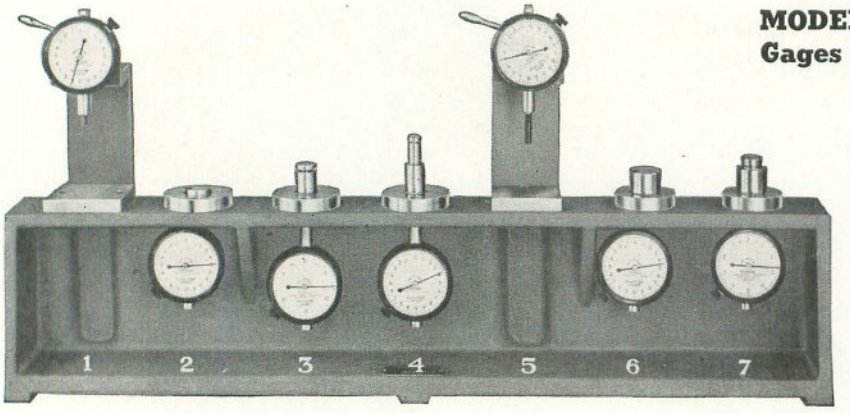
MODEL 1315 B-4

A band-type Circumference Gage which has simplicity of design, yet great speed in the checking of Peripheral Lengths to .0005" limits.

PROGRESSIVE MULTI-STATION GAGES

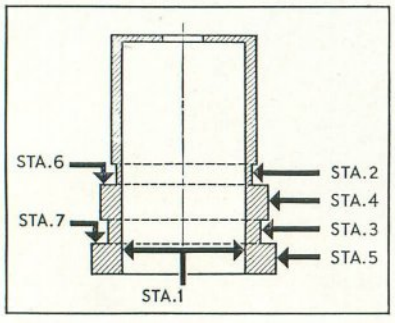


Progressive multi-station gaging of any workpiece provides great savings both in inspection time and gage cost, as it concentrates all dimensional inspections of a given class into one gage at one place and in the hands of one operator. Instead of numerous special and sometimes expensive gages, simple Dial Indicators can be properly mounted in the fixture and fitted with correct reference anvils, thus permitting fast, accurate, logical-sequence measurement of the critical dimensions. Also, in-plant transportation of parts between inspection stations is greatly reduced.



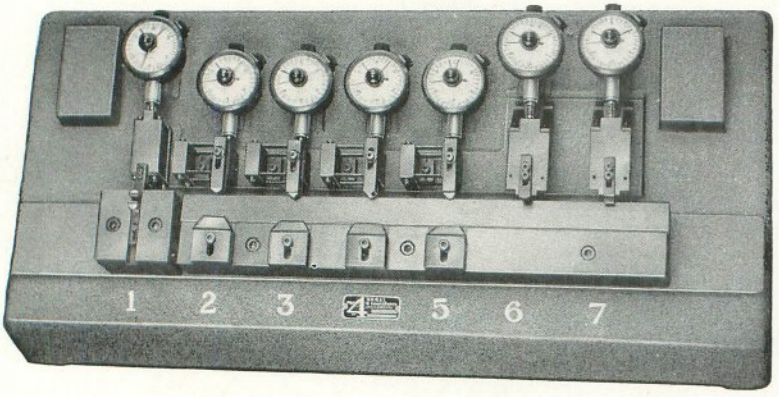
MODEL 247 B-110
Gages 2 External and 5 Internal Dimensions

The Gage shown at left inspects 2 overall heights and 5 internal shoulder depths, but it is entirely within the scope of progressive gaging to include stations for all types of measurement, i.e., inside diameter, outside diameter, thickness, length, width, parallelism, concentricity, and thread pitch diameter and lead. This type of Gage can also be made semi-circular for increased operating efficiency when the number of stations requires a greater length of fixture.



MODEL 236 B-226
Checks One I.D., 4 O.D.'s and 2 Heights

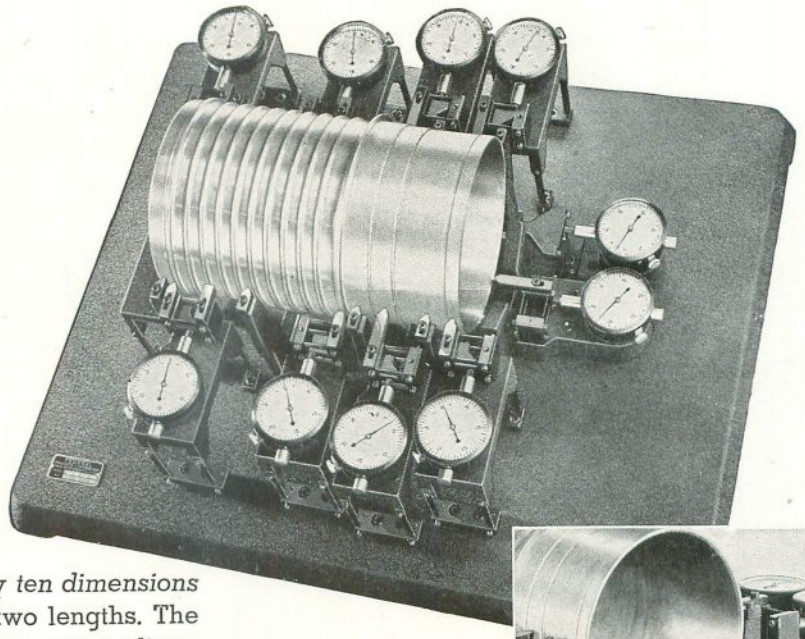
The straight-line, multi-station, progressive method of gaging was selected in this instance because the small size and delicacy of the part did not permit designing an efficient one-position, simultaneous Multiple-Inspection Gage, and also because faster gaging could be obtained with the straight-line progressive method. Actually, this gage could have been designed to inspect more than 7 dimensions but our customer felt it more desirable, because of his particular inspection set-up, to divide the total number of inspections between 2 gages. The gaging stations are correctly spaced to provide maximum speed and convenience in the gaging sequence, with full consideration being given to securing the maximum utilization of the hand and arm motions.

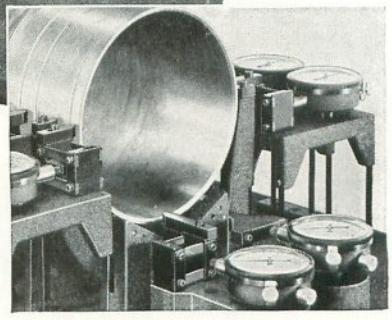


This gage is a good example of what can be accomplished in reducing inspection cost on high-production parts *not* having close tolerances. In other words, Federal-designed Gages can effect substantial economies on inspections involving tolerances in thousandths as well as tenths of thousandths.

SIMULTANEOUS MULTIPLE-INSPECTION GAGES

Simultaneous multiple-inspection gages were pioneered by Federal many years ago. Development and skill in designing Multiple-Inspection Gages, however, have increased greatly and with more efficient results in late years. Federal has introduced flexibility and basic principles in Multiple-Inspection Gages so that now these instruments have the sensitivity, accuracy, and efficient qualities of the more simple single-purpose gages.





END VIEW showing reed suspension of Diameter inspection units and lengths inspection Indicators.

MODEL 247 B-72 DIAMETER AND LENGTH GAGE

Model 247 B-72—This gage checks simultaneously *ten dimensions* on this cylindrical sleeve—eight diameters and two lengths. The Indicators on either side of the workpiece check the various diameters while the two Indicators at the end check lengths (see illustration). One checks the entire length of the part and the other checks the length from the flange to the left-hand end at a point beneath the cylinder. Each diameter gaging Indicator is an individual unit and its action in no way depends on any other unit, thus each diameter is inspected independently of any eccentricity which may exist between them.

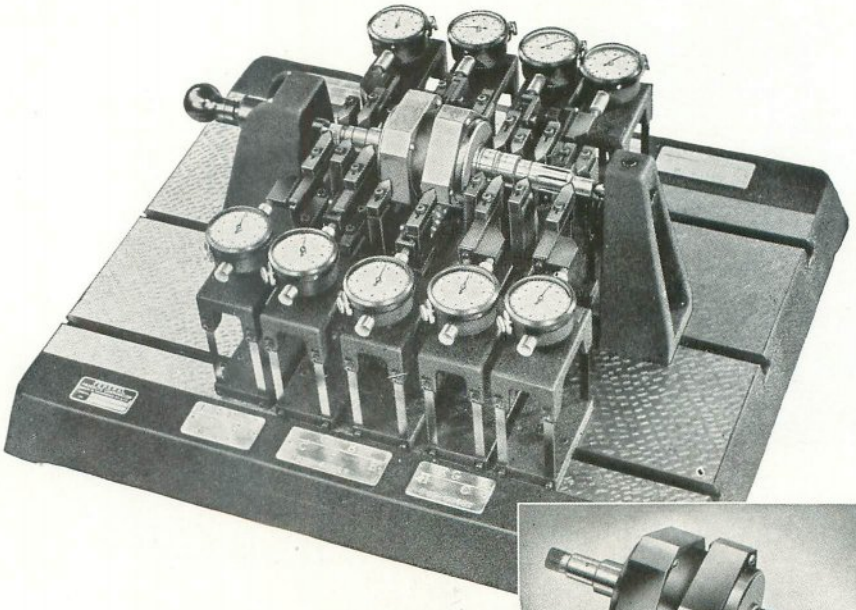
The cylindrical sleeve is positioned easily in the gage by placing it on V-shaped locating contacts. These contacts may be provided with rollers for heavy work, if desired.

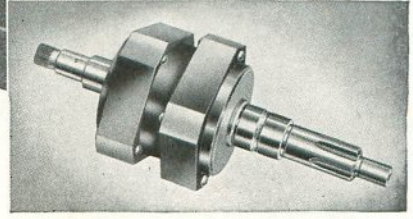
MODEL 236 B-123 UNIVERSAL DIAMETER

Model 236 B-123, inspects, simultaneously, nine diameters for accuracy. Each diameter is checked *independently* of the other by an Indicator unit which is supported on reeds and is therefore free to adjust itself in case any diameter is not concentric with the others.

The Indicator does not come in immediate contact with the workpiece but contacts the diameter through a pantograph unit which increases the sensitivity of the inspection and at the same time protects the Indicator from damage.

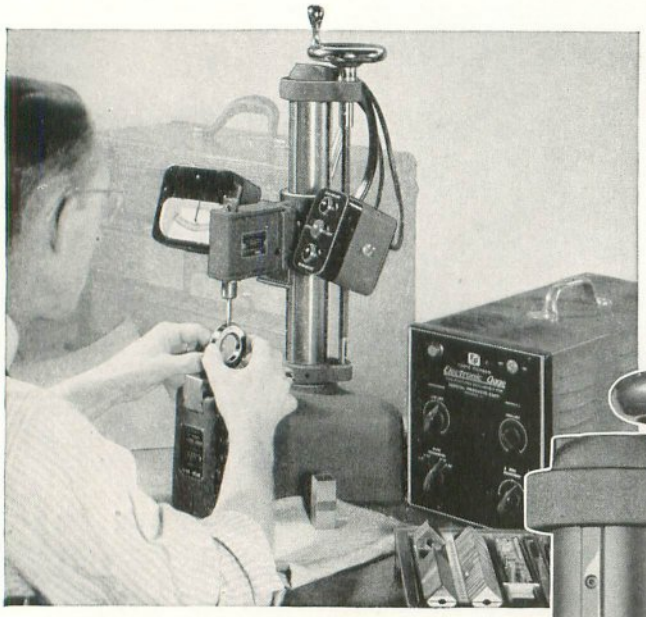
All units are adjustable so that many combinations of diameters may be inspected. Any length of shaft up to 12" long and any diameter up to 4" can be handled on this gage.





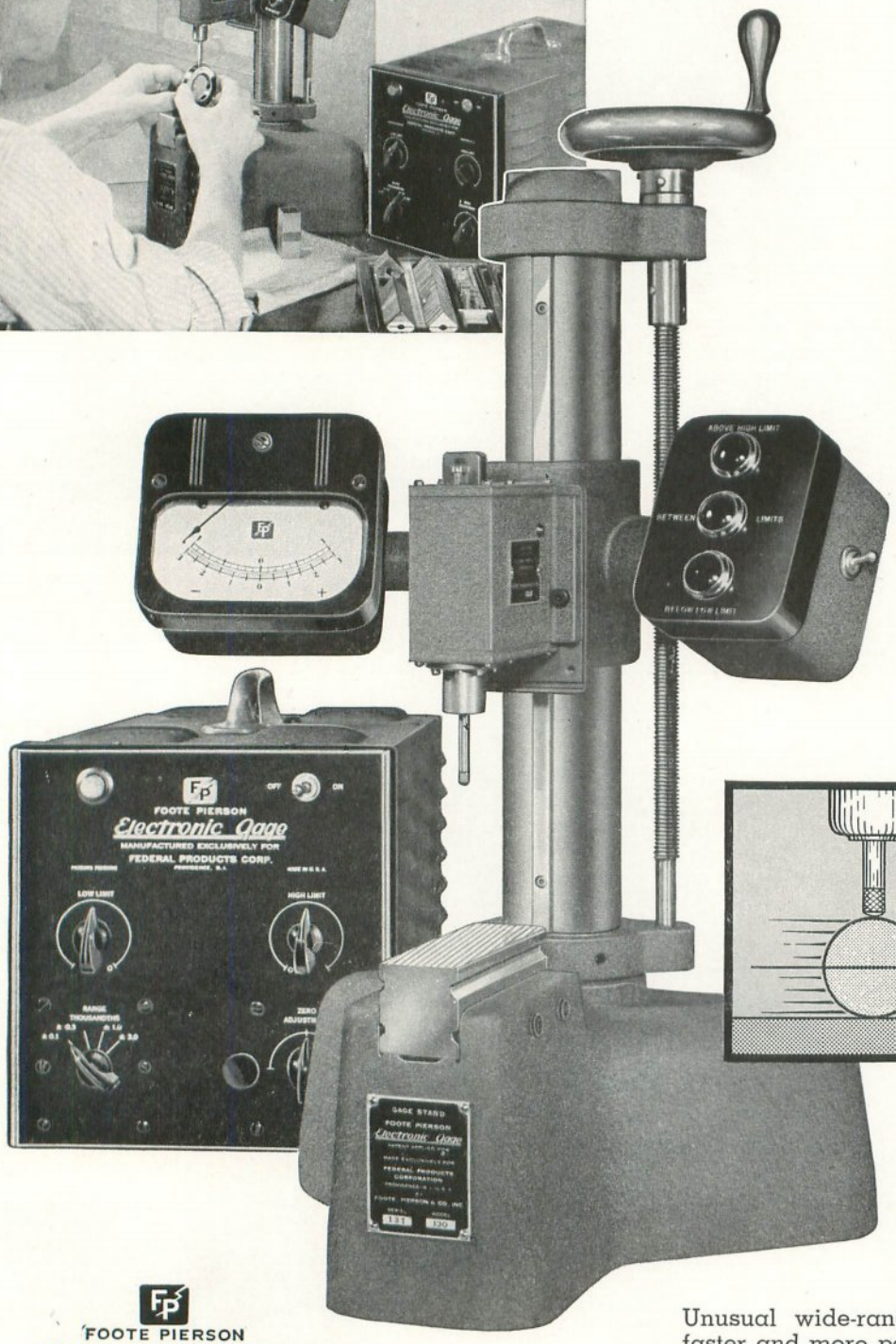
THE INSPECTED PIECE. Thousands of similar pieces can be inspected as efficiently.

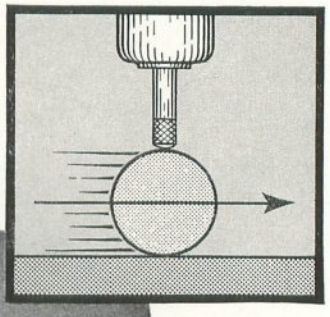
ELECTRONIC GAGE



FASTER, MORE SENSITIVE PRECISION

It has both
GRADUATED DIAL for Selective Sorting
LIMIT LIGHTS for fast "Within-Limits" Gaging





ONE-PASS INSPECTION

Workpiece is passed *directly* under contact. No stopping and no backstop required. 30 to 60% faster inspection, accurately.

OUTSTANDING BECAUSE—

Limit lights show immediately any variation in specified dimension. No hesitation, no backstop, positive.

No maximum and minimum masters required to set dimension limits.

Unusual wide-range zero adjustment makes setup simpler, faster and more positive.

Contact pressure adjustable from 1½ to 16 ozs.

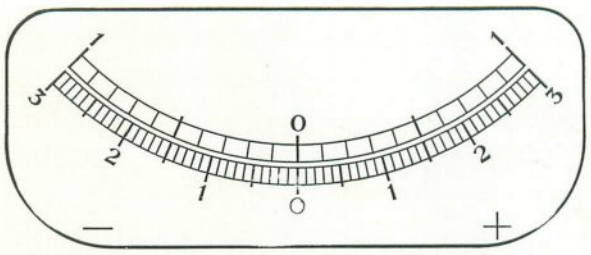
Easy selection of any one of four magnifications enable readings from .000010" to .003". Even finer readings can be estimated.

FOOTE PIERSON
Electronic Gage
MANUFACTURED EXCLUSIVELY FOR
FEDERAL PRODUCTS CORPORATION

MODEL 130

FOUR MAGNIFICATIONS on the SAME Dial

The Indicator Dial, in combination with the electronic circuit of the Gage, provides FOUR degrees of magnification to meet your needs, permitting measurements from 10 millionths (.000010") to .003". Pre-selection of a dial to give the degree of magnification desired is unnecessary. Dial markings are well-spaced and clear to assure maximum legibility when Gage is used "on Indicator" for selective sorting; i.e., determination of *how much* the part varies from the nominal dimension and the correlated sorting of workpieces in accordance with their dimensional variations.



FOUR MAGNIFICATIONS available, using both the fine and the coarse scales; providing dimensional readings from ten millionths (.000010") to .003". Scale is shown actual size.

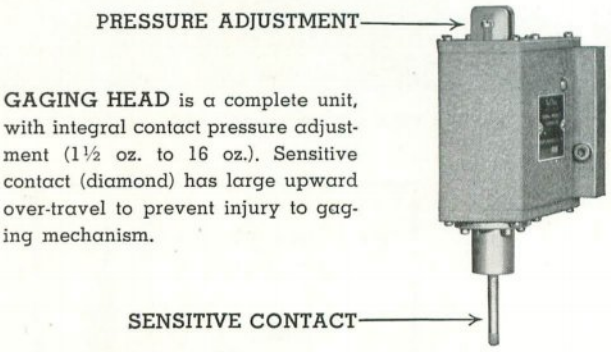
Instantaneous LIMIT LIGHTS

You see the light "flash" instantly:—Green, OK (within limits); Red, oversize; Amber, undersize—quicker than you can read the Indicator. No need to maneuver the workpiece under the contact to get the maximum reading. Just pass the work through—one pass only—while you watch the lights. Gaging is accurate, positive, and extremely fast. Ideal for "within-limits" gaging.

LIMIT LIGHTS, instantaneous in action, speed "within-limits" gaging. One-pass inspection; no maneuvering, no stopping, no back stop.

CONTACT PRESSURE Adjustable from 1½ oz. to 16 oz.

To prevent marring or deforming soft or thin-walled parts, the pressure of the diamond contact point can be quickly adjusted to as little as 1½ oz. Depending upon the hardness of the surface, wall thickness, surface contours and speed of movement of workpiece under the gaging contact, this pressure can be increased up to 16 oz. to give "best" gaging condition.



GAGING HEAD is a complete unit, with integral contact pressure adjustment (1½ oz. to 16 oz.). Sensitive contact (diamond) has large upward over-travel to prevent injury to gaging mechanism.

EASIER SETTING to Master

Only one Master is required (maximum and minimum masters not necessary), and this master need not be of the exact specified dimension. As long as the gage block or master actuates the pointer within the limits of the Indicator scale, the Gage can be set exactly to the required dimension. The elevating screw and handwheel gives quick approximate adjustment throughout vertical range of 6⅛".

SIMPLIFIED CONTROLS FACILITATE SET-UP

SPECIFICATIONS

Magnifications	Four
Value, Minimum Graduations on both Fine and Coarse Scales	.00010" / .000010"
Maximum Measuring Range	±.003"
Indicator, Balanced	Upper 1–0–1 / Lower 3–0–3
Maximum Vertical Capacity (Sensitive Contact to Anvil)	6⅛"
Maximum Throat Depth	4¼"
Column Diameter	2"
Sensitive Contact	Diamond (Special contacts furnished extra)
Contact Pressure, Adjustable	1½ to16 oz.
Reference Anvil, Ground and Lapped	4½" × 1⅜" (Reversible; one side smooth, opposite serrated)
Power Supply	110 V (±10%), 60 cycle, A. C.
Height	Gage 19" / Control Box 8¾"
Net Weight	Gage 58 lbs. / Control Box 28 lbs.

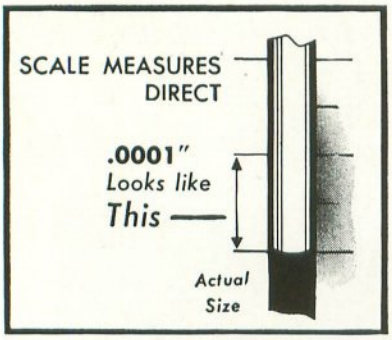
AIR GAGE

The same column, the same scale for all three gaging plugs.

HIGH MAGNIFICATION

DIRECT MEASURING

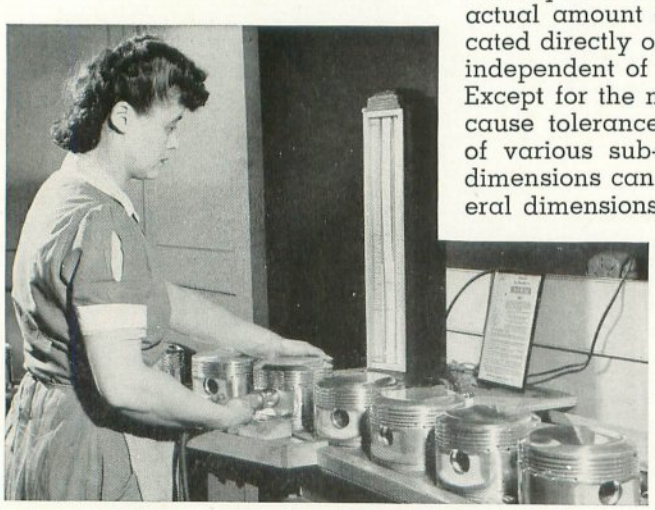
MINIMUM OPERATOR INFLUENCE



A DIRECT READING PRECISION MEASURING SYSTEM

The Federal-Metricator System of gaging dimensions by a flow of air provides a means for obtaining an even higher degree of accuracy in precision measuring. And, at the same time, it provides a solution to many gaging requirements difficult to solve by other means. It does this by a simpler, more direct means of using air flow to magnify dimensions which result in several advantages.

This system differs from others in that it measures *directly*. The actual amount of the dimension variation of the workpiece is indicated directly on the scale. Moreover, it does this on the *same* scale independent of any change in the size of the gaging plug or head. Except for the most accurate work, only one master is required because tolerances can be determined directly on the scale. Scales of various sub-divisions can be supplied when needed. Multiple dimensions can be gaged simultaneously on multiple scales or several dimensions can be measured progressively on a single scale.



Two dimensions are inspected simultaneously on a double column.

The F-M System eliminates all need for direct mechanical measuring contact with the surfaces of the work being measured. Thus it does not mar fine surface finishes and it is adaptable to continuous measurement of soft materials. The human influence in measuring is also reduced to a minimum; the gaging head does *not* have to be handled with skill. There is nothing to stick or interfere with the gaging operation or the reading of the scale. It is the simplest to install and to use.

AIR FLOW IS THE GAGING MEDIUM

Air supplied either from the plant air lines or a small compressor is reduced to the ¾ lb. pressure required for gaging. Constant air flow is then maintained hydraulically and by a master jet within the Indicating Column. Thus uniform gaging conditions are guaranteed by the underlying design of the instrument; this makes any gaging plug or head adaptable to all Federal-Metricator Indicating Columns.

The gaging head is calibrated to the Indicating Scale by means of one master. Variations in the workpiece size from the master result in PLUS or MINUS readings on the Indicating Scale. Actual workpiece dimension, not just "go" or "no-go", is easily read down to 25 millionths (.000025"). Range of readings on regular models is .002". Amplification is 4,000:1.

LONG LIFE OF GAGING HEADS

Regular F-M gaging heads are chromium plated, will stand up under the most severe treatment. Even when worn there is no "closing-in" of tolerance limits on the scale. They hold *effective tolerance* throughout their life and give definite warning when worn beyond their size limits.

LOW-COST AIR GAGE PLUGS

Non-plated hole gaging plugs (type B-280) are available for high precision, short run jobs between .240" and 2.510" I.D. These plugs, while not as durable as regular types, are built to deliver the same magnification without damage to surface finish and free from operator influence — at the right price for shorter jobs.

MULTIPLE DIMENSION GAGES

Two or more dimensions can be measured simultaneously with the F-M Air Gage. For example the I.D. and O.D. of thin, soft bearing liners are closely measured in one operation using a ring and plug combination gage and a double Indicating Column.

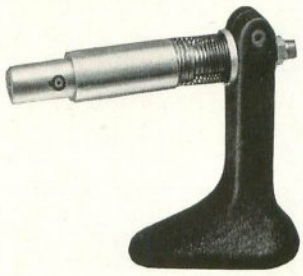
SPECIAL GAGES

Using special fixtures, practically any type of measurement is within the scope of the Federal-Metricator. Concentricity, thickness, squareness, straightness, width, length, flatness, taper and angularity are a few of the special jobs filled by F-M. In one case, F-M replaced sapphire plug gages in checking the .040" I.D. of a spark plug. The abrasive quality of the spark plug was too much for all other gaging instruments. F-M not only measured the hole more accurately — it did it without gage wear.

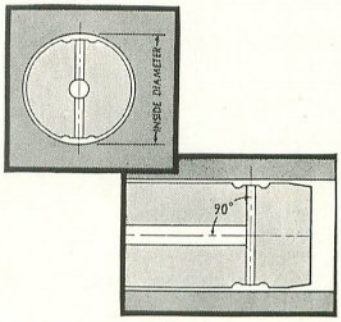
SPECIFICATIONS AND DATA

Magnification (regular — higher if required)	4,000:1
Work range (regular)	.002"
Measurements readable to	.000025"
Operating Pressure	¾ lbs.
Compressor, HP	1/12
Dimensions of Indicating Column	25½" x 8" x 9"
Shipping Weight	33 lbs.

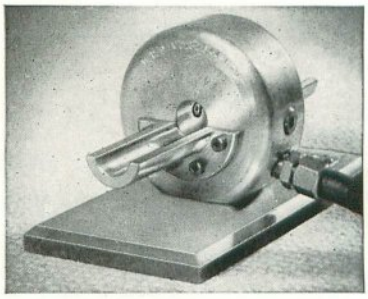
ONLY ONE MASTER is required. All regular gaging heads have the same magnification and conform to the same Indicating Scale.



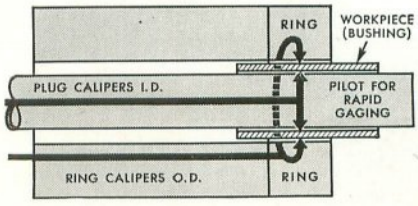
BENCH FIXTURE WITH GUIDE SLEEVE — two features which make for faster application of the workpiece to the plug.



GAGING JETS automatically located. Hole is inspected throughout for I.D., taper, out-of-round, etc.

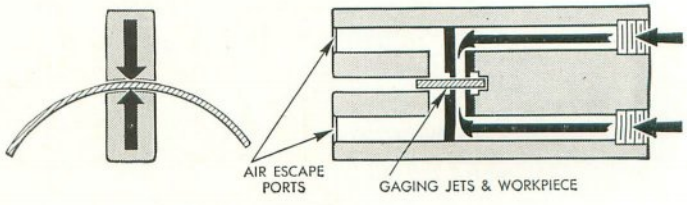


O.D. GAGING RING WITH CHUTE for easy insertion and removal of workpieces.



SPECIAL GAGE for simultaneous I.D. and O.D. inspection.

FIXTURE for gaging wall thickness of soft bearing liners. No gaging tension to mar the finish.



CONVERSION TABLES

DECIMAL AND MILLIMETER EQUIVALENTS FOR FRACTIONAL PARTS OF AN INCH

Fractional Inches	Decimal Inches	Millimeters	Fractional Inches	Decimal Inches	Millimeters	Fractional Inches	Decimal Inches	Millimeters
1/64	0.015 625	0.396 88	21/64	0.328 125	8.334 39	45/64	0.703 125	17.859 41
1/32	0.031 25	0.793 75	11/32	0.343 75	8.731 27	23/32	0.718 75	18.256 29
3/64	0.046 875	1.190 63	23/64	0.359 375	9.128 14	47/64	0.734 375	18.653 16
1/16	0.062 5	1.587 50	3/8	0.375	9.525 02	3/4	0.75	19.050 04
5/64	0.078 125	1.984 38	25/64	0.390 625	9.921 89	49/64	0.765 625	19.446 91
3/32	0.093 75	2.381 26	13/32	0.406 25	10.318 77	25/32	0.781 25	19.843 79
7/64	0.109 375	2.778 13	27/64	0.421 875	10.715 65	51/64	0.796 875	20.240 67
1/8	0.125	3.175 01	7/16	0.437 5	11.112 52	13/16	0.812 5	20.637 54
9/64	0.140 625	3.571 88	29/64	0.453 125	11.509 40	53/64	0.828 125	21.034 42
5/32	0.156 25	3.968 76	15/32	0.468 75	11.906 27	27/32	0.843 75	21.431 29
11/64	0.171 875	4.365 63	31/64	0.484 375	12.303 15	55/64	0.859 375	21.828 17
3/16	0.187 5	4.762 51	1/2	0.50	12.700 03	7/8	0.875	22.225 04
13/64	0.203 125	5.159 39	33/64	0.515 625	13.096 90	57/64	0.890 625	22.621 92
7/32	0.218 75	5.556 26	17/32	0.531 25	13.493 78	29/32	0.906 25	23.018 80
15/64	0.234 375	5.953 14	35/64	0.546 875	13.890 65	59/64	0.921 875	23.415 67
1/4	0.25	6.350 01	9/16	0.562 5	14.287 53	15/16	0.937 5	23.812 55
17/64	0.265 625	6.746 89	37/64	0.578 125	14.684 40	61/64	0.953 125	24.209 42
9/32	0.281 25	7.143 76	19/32	0.593 75	15.081 28	31/32	0.968 75	24.606 30
19/64	0.296 875	7.540 64	39/64	0.609 375	15.478 16	63/64	0.984 375	25.003 18
5/16	0.312 5	7.937 52	5/8	0.625	15.875 03	1	1.000 00	25.400 05
			41/64	0.640 625	16.271 91			
			21/32	0.656 25	16.668 78			
			43/64	0.671 875	17.065 66			
			11/16	0.687 5	17.462 54			

DECIMAL INCH EQUIVALENTS OF MILLIMETERS AND FRACTIONAL PARTS OF MILLIMETERS

mm Inches	mm Inches	mm Inches	mm Inches	mm Inches
1-100 = .00039	26-100 = .01024	51-100 = .02008	76-100 = .02992	2 = .07874
2-100 = .00079	27-100 = .01063	52-100 = .02047	77-100 = .03031	3 = .11811
3-100 = .00118	28-100 = .01102	53-100 = .02087	78-100 = .03071	4 = .15748
4-100 = .00157	29-100 = .01142	54-100 = .02126	79-100 = .03110	5 = .19685
5-100 = .00197	30-100 = .01181	55-100 = .02165	80-100 = .03150	6 = .23622
6-100 = .00236	31-100 = .01220	56-100 = .02205	81-100 = .03189	7 = .27559
7-100 = .00276	32-100 = .01260	57-100 = .02244	82-100 = .03228	8 = .31496
8-100 = .00315	33-100 = .01299	58-100 = .02283	83-100 = .03268	9 = .35433
9-100 = .00354	34-100 = .01339	59-100 = .02323	84-100 = .03307	10 = .39370
10-100 = .00394	35-100 = .01378	60-100 = .02362	85-100 = .03346	11 = .43307
11-100 = .00433	36-100 = .01417	61-100 = .02402	86-100 = .03386	12 = .47244
12-100 = .00472	37-100 = .01457	62-100 = .02441	87-100 = .03425	13 = .51181
13-100 = .00512	38-100 = .01496	63-100 = .02480	88-100 = .03465	14 = .55118
14-100 = .00551	39-100 = .01535	64-100 = .02520	89-100 = .03504	15 = .59055
15-100 = .00591	40-100 = .01575	65-100 = .02559	90-100 = .03543	16 = .62992
16-100 = .00630	41-100 = .01614	66-100 = .02598	91-100 = .03583	17 = .66929
17-100 = .00669	42-100 = .01654	67-100 = .02638	92-100 = .03622	18 = .70866
18-100 = .00709	43-100 = .01693	68-100 = .02677	93-100 = .03661	19 = .74803
19-100 = .00748	44-100 = .01732	69-100 = .02717	94-100 = .03701	20 = .78740
20-100 = .00787	45-100 = .01772	70-100 = .02756	95-100 = .03740	21 = .82677
21-100 = .00827	46-100 = .01811	71-100 = .02795	96-100 = .03780	22 = .86614
22-100 = .00866	47-100 = .01850	72-100 = .02835	97-100 = .03819	23 = .90551
23-100 = .00906	48-100 = .01890	73-100 = .02874	98-100 = .03858	24 = .94488
24-100 = .00945	49-100 = .01929	74-100 = .02913	99-100 = .03898	25 = .98425
25-100 = .00984	50-100 = .01969	75-100 = .02953	1 = .03937	26 = 1.02362

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